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HEADQUARTERS
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Washington, DC, 30 March 1979

ENGINEER COMBAT OPERATIONS

The primary purpose of this manual is to provide combat unit commanders, their staffs and personnel with information pertaining to the role of the engineer as he interacts and interrelates with the combined arms teams.

Users are encouraged to recommend changes or provide comments to improve the manual. Comments should be keyed to the specific page, paragraph, and line of the text in which the change is recommended. Reasons should be provided for each comment to insure understanding and proper evaluation. Comments should be forwarded by letter or by DA Form 2028 (Recommended Change to Publications) directly to the Commandant, US Army Engineer School, ATTN: ATZA-TDL, Fort Belvoir, VA 22060.

To comply with guidance of the Assistant Secretary of Defense (Manpower and Reserve Affairs), this Field Manual has been reviewed for the use of neutral language. Unless otherwise noted, the word "he" will include both masculine and feminine genders.

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*This publication supersedes FM 5-135, 11 May 1970; and FM 5-136, 15 October 1970, including all changes.

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*in your mind be an engineer;
in your heart be an infantryman.*

Preface

Today more than ever before, the engineer plays a critical role as a member of the combined arms team. As movement and lethality on the battlefield increase, the requirement to reinforce the terrain increases. The engineer brings to the combined arms team a terrain oriented system that enhances the capability of our weapon systems while decreasing the effectiveness of the enemy weapons.

Obstacle reduction. Orients on reducing or negating the effects of obstacles to improve movement of maneuver/weapon systems and critical supplies.

Mobility

Obstacle construction. Reinforcement of terrain to delay, disrupt, and kill the enemy. Increases time for target acquisition and enhances the effectiveness of our weapons.

Countermobility

Protective position development. Development of earth berms, dug-in positions, overhead protection, and countersurveillance measures to reduce the effectiveness of enemy weapon systems.

Survivability

Those engineer missions which do not directly contribute to the mobility, countermobility, and survivability of committed maneuver units but which are essential for their firepower and logistic support.

General Engineering

This manual focuses on the division area of operations. It is in the division area that the first battle will be won; therefore, it is here that the contribution of the engineer system will be most critical. The engineer system is oriented towards the front, focusing its effort and capabilities on the requirements of the maneuver elements. The organic division engineer battalion is the focal point of the combat engineer effort. This unit plans and executes the engineer combat mission utilizing the collective strength of the engineer system which includes augmentation and reinforcement by corps engineer units.

As this manual is being written, significant combat engineer developments are in progress which infuse new equipment, organizations, and techniques into the engineer systems. Only those developments expected to be available in the field by 1978 are considered in the main body of the manual. Future developments beyond 1978 are treated separately in chapter 6.



THE MODERN BATTLEFIELD

THE BATTLEFIELD. The battlefield armies of the next major war will be highly mobile and use weapon systems that deliver more firepower far more accurately than ever before. Within the next 10 years the engineer system will undergo a more drastic improvement in equipment and capability than almost any other system in the Army. This improvement will not only keep pace with the modern battlefield but will provide a new dimension to the engineer contribution to the battle.

GENERAL OVERVIEW

The continuing development and refinement of material and tactics/techniques by NATO and Warsaw Pact forces have significantly changed the complexion of the modern battlefield. Opposing armies now have a significantly greater ability to locate and destroy an enemy force than ever before. Tremendous advances in technology have created new families of weapons, communications, and surveillance devices.

MOBILITY. Since World War II, all armed forces have pursued heightened mobility through advanced technology and organizational forms adapted to new means of moving, shooting, and communicating. By the mid-70's, there was a pronounced organizational trend toward increasing the percentage of armored and mechanized troops in Soviet-equipped ground forces. Airmobility was also being stressed, although less prominently than in US doctrine. There are, however, increasing indications of added reliance on attack helicopters in an antitank role in direct support of maneuver elements.

FIREPOWER. Hand in hand with the increased use of massed armor formations, we have made tremendous advances in weapons technology. Weapons now are more accurate, have longer ranges, and are more lethal than ever before. Few weapons have had a greater influence on the development of modern tactics than the antitank guided missile (ATGM). Armed with the ATGM, the

infantry has now become an extremely potent tank-killing force on the battlefield. Furthermore, infantry now has the capability to support tanks by fire in much the same way as tanks once supported infantry. More tanks can now be freed for their classic role in the offense and exploitation, utilizing their firepower, mobility, and shock effect.

COVER/CONCEALMENT. The combination of greater mobility and increased firepower of the weapons creates some new problems and amplifies some old ones. The ability of an enemy to detect, engage, and kill targets at ranges out to 3,000 meters with ground weapons, and at almost unlimited ranges, with aircraft, places increasing importance on the need to conceal and cover dispositions and movement. Movement patterns for armored formations are changed. Wooded areas and other terrain features, not previously considered as primary armor approaches, now become the norm. Formations must become more

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dispersed, yet must remain mutually supporting. This, in conjunction with the fluidity of the battlefield, presents the engineer with an ever-increasing array of problems.

LETHALITY. From all of this, then, it is easy to see that the increased lethality and sophistication of weapons — particularly armor-defeating weapons — and the proliferation of these weapons with combat units will greatly affect the employment of armored and mechanized forces in any future conflict. Indeed, the Arab-Israeli War of 1973 reflects the nature of combat as it has evolved because of these changes in materiel. In a period of 20 days, more than 1,700 tanks were destroyed — as many tanks as there are in five US armored divisions. This was due largely to the fact that in many instances new families of weapons were being used in conjunction with old tactics. Clearly, no force could sustain such losses for very long — even such powerful armies as those of the USSR or the USA. While the tank remains the decisive weapon on the battlefield, the figures clearly show that it is being challenged by properly employed antiarmor weapons.

DURATION. The first battle of our next war could well be its last battle; belligerents could be quickly exhausted, and international pressures to stop fighting could bring about an early cessation of hostilities. The United States could find itself in a short, intense war - the outcome of which may be dictated by the results of initial combat. This circumstance is unprecedented; we are an Army historically unprepared for its first battle. We are accustomed to victory wrought with the weight of material and population brought to bear after the onset of hostilities. Today the US Army must, above all else, prepare to win the first battle of the next war. Once the war is upon us, we shall aim at emerging triumphant from the second, third, and final battles as well.

***Prepare To Win the First
Battle of the Next War***

**ENGINEER
TRENDS
IN THE
DIVISION**

The major trends in the combat engineer system focus on changes in the modern battlefield. Trends include:

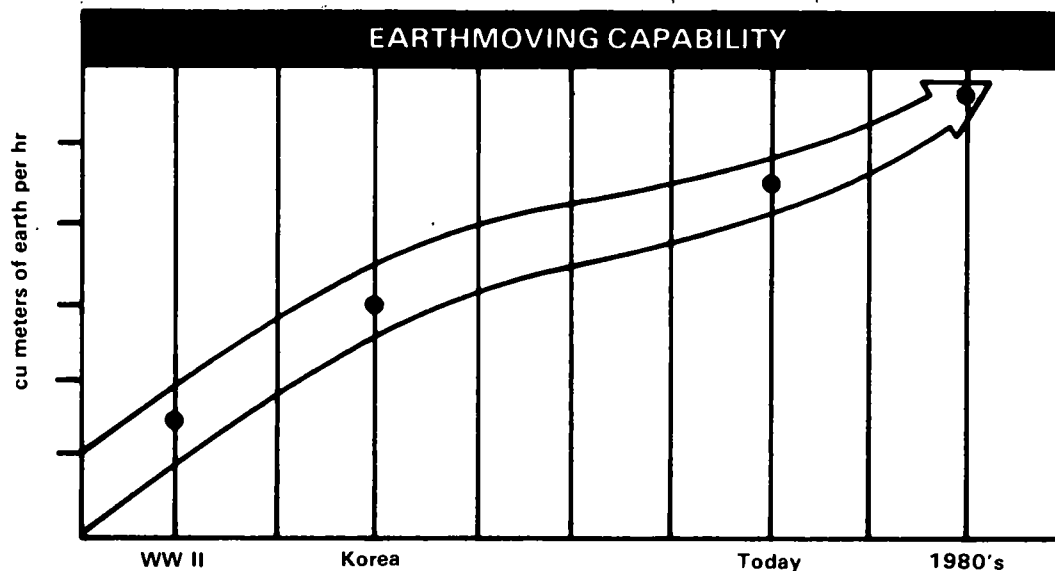
An increase in mobility commensurate with the division maneuver elements.

A significant increase in the mine dispensing capability of division forces.

An increase in the working capability and survivability of engineer equipment.

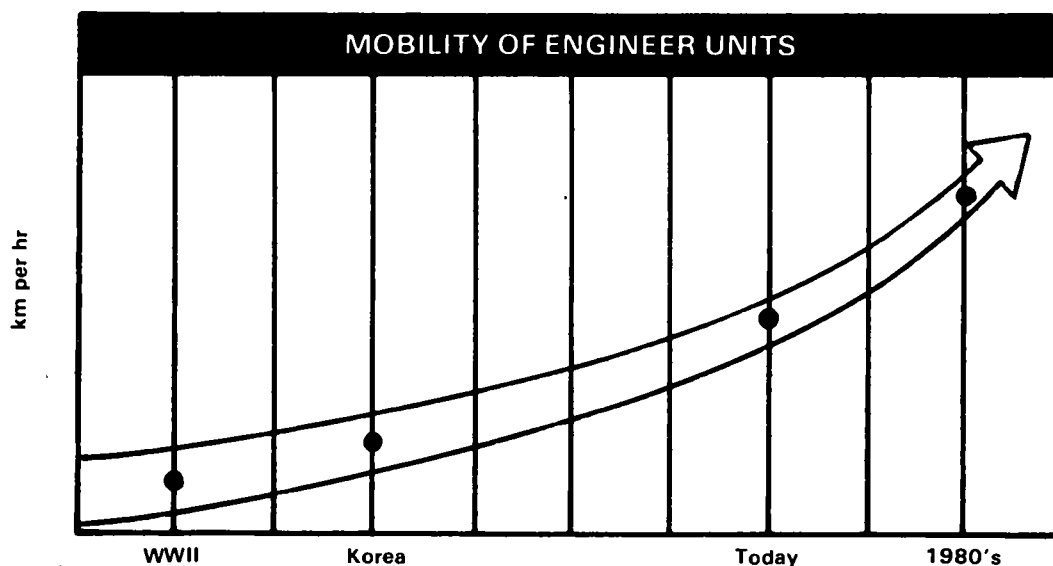
Concentration of engineer forces forward in the main battle area.

Along with the tremendous advances in weapons technology for the maneuver units, great strides have been made in improving earthmoving equipment. The following chart shows the increased *earthmoving capability of the divisional engineer company*.



This allows the division increased capability to dig in its weapon systems and enhance the survivability of the maneuver units.

As a part of the combined arms team, the divisional engineer's mobility has increased to keep up with the maneuver units in cross-country movement.

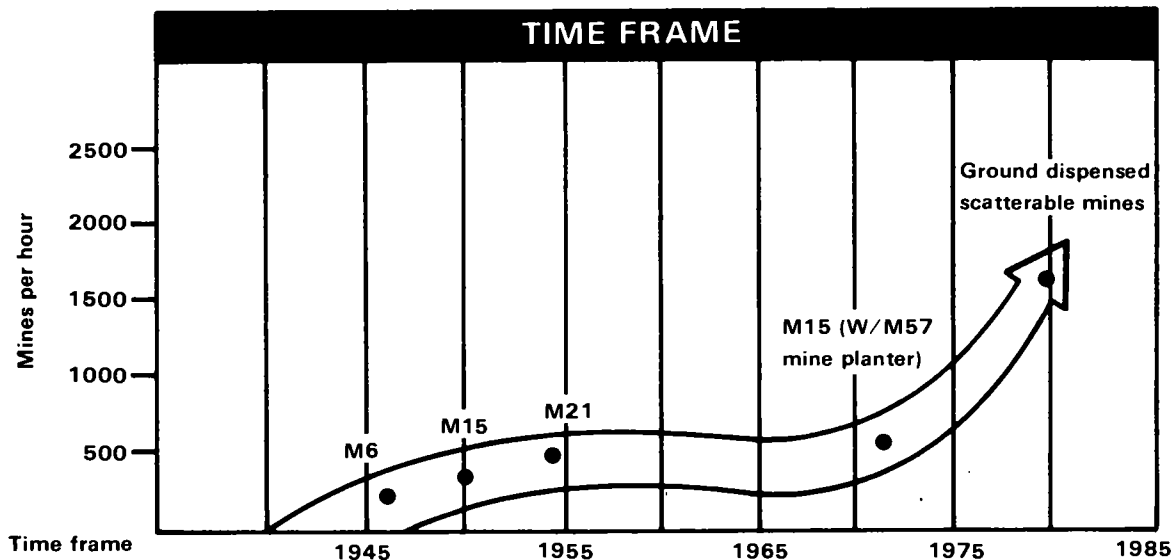


Engineers move and fight side by side with other combined arms in the division.

Engineers move and fight side by side with other combined arms in the division. During WW II, extensive use of mines by defending forces contributed significantly to the destruction of attacking tank forces. However, the requirement to hand-emplace mines severely hampered tactical employment. Because of the time, manpower, and logistic support required, mines were emplaced before an enemy attacked and minefield locations were based solely on the commander's analysis of how the enemy would attack and use the terrain, rather than on the enemy's actual movements.

During the past few decades, mines were relatively inefficient because of the large amount of explosives required to immobilize or destroy a tank. In the mid 70's, however, the US made dramatic advances in increasing mine lethality while decreasing size. This decreased size now permits the rapid delivery of scatterable mines by engineer, artillery, high performance aircraft, and helicopter systems. Using hand emplaced mines, the average engineer company takes nearly eight hours to lay a 350- by 250-meter minefield. Using scatterable mines, this same minefield can be

A complete family of scatterable mines will be fielded in the near future. Mine warfare concepts are changing.

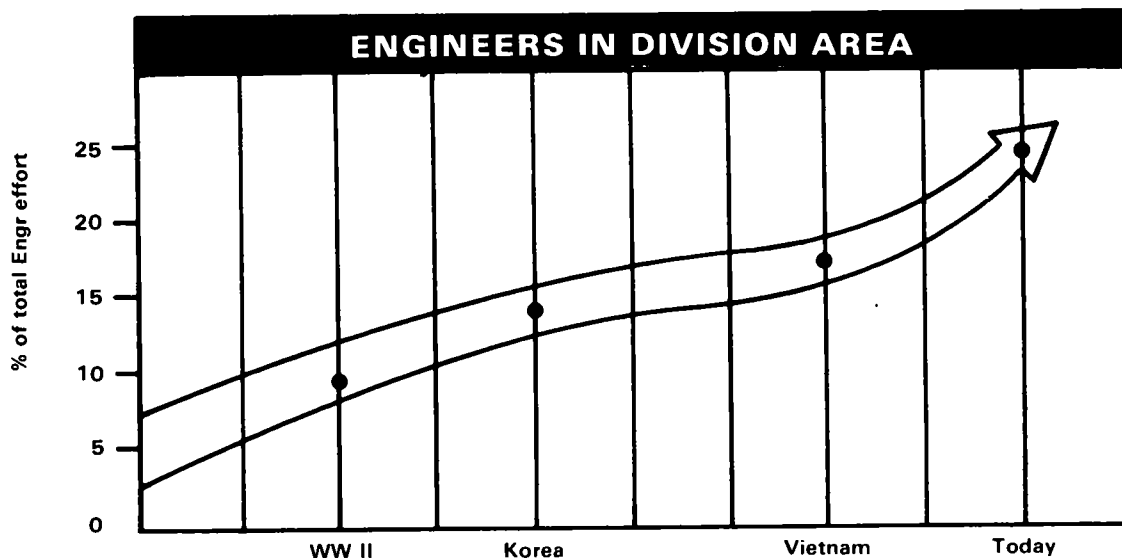


The engineer is the planner and primary "doer" for mine warfare. The combined arms team looks to the engineer to effectively integrate mine-field systems into the modern battlefield.

laid in a matter of minutes. This rapid delivery system allows the tactical commander to emplace mines directly in front of an advancing enemy or within his formations.

As enemy forces approach and come within range of our ATGM and tanks, mines can be delivered to canalize and slow the attack. The use of mines can provide needed time for our tank and ATGM gunners to engage the massive array of targets.

Engineers, by providing mobility, countermobility, and survivability to the division, are vital to success on the modern battlefield. As the mobility of forces and lethality of weapons have increased, MORE ENGINEER EFFORT has moved forward to fight with the committed maneuver units.





Chapter 2

THE ENGINEER SYSTEM

THE ENGINEER SYSTEM fights as an integral part of the combined arms team. The impetus is to employ the engineer system as far forward as possible with the committed maneuver units.

GENERAL DESCRIPTION

The engineer system consists of division and corps engineer assets located in the division area. The system contains the skills and equipment necessary to enhance friendly mobility and survivability, to counter the mobility of opposing forces, and to accomplish general engineering work.

THE ENGINEER SYSTEM:

Is composed of division and corps engineers that can be shifted to weight effort at the critical time and place.	Provides sustaining or general engineering to all division systems.
Provides a single point of contact for all engineer activities in the division.	Is a combat power multiplier that reinforces terrain to the advantage of friendly forces.
Emphasizes forward support to maneuver elements.	Establishes normal unit relationships with maneuver elements that strengthen the combined arms concept.

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THE ENGINEER SYSTEM PROVIDES:

- 1 MOBILITY**
- 2 COUNTERMOBILITY**
- 3 SURVIVABILITY**
- 4 GENERAL ENGINEERING**

1 MOBILITY

Mobility is obstacle reduction. It is oriented toward reducing or negating the effects of existing or reinforcing obstacles to improve movement of maneuver/fire units and movement of critical supplies.

The delaying effects of natural terrain are magnified by the enemy's attempt to block all avenues of approach. *Engineers clear the way.* They:

Fill craters and ditches by dozing or hauling fill material.

Demolish and remove road blocks, trees, or rubble.

Make quick bypasses around obstacles.

Clear paths through minefields with mechanical equipment or rocket-propelled line charges.

Span gaps with assault bridging.

Make combat trails through wooded and heavily vegetated areas.

Maneuver units must be able to move laterally to concentrate as well as to advance forward. They must be able to move into and out of battle positions using the best covered and concealed routes available. Engineers improve trails and develop new paths. The work is expedient; the routes may not last more than a few hours but mobility has been enhanced.

Engineer work in the forward areas is quick and expedient; it keeps maneuver forces moving.

Engineers work and fight with forward maneuver elements to insure continuous mobility. Engineers are *part of the unit's combat power*. For example, combat engineer vehicles (CEVs) and engineer squads march with and directly support the lead elements of maneuver units.

Engineers are equipped to breach obstacles. Bypasses are often required to maintain momentum. The complete removal or reduction of large obstacles is the responsibility of follow-on engineers who provide general engineering.

The division's mobility and effectiveness must be sustained. Essential routes and facilities require capabilities that often exceed the division engineer's assets. *Corps engineers* augment with more sophisticated means to *maintain the way*.

2 COUNTERMOBILITY

Engineers install obstacles to reduce the enemy's mobility and effectiveness. Obstacles contribute to the division's tactical scheme by increasing time—

To concentrate forces at critical battlefield locations.
To assist target acquisition and development.
To destroy targets.

<i>Some obstacles destroy targets—most enhance or complement weapon effectiveness.</i>

To be most effective, *obstacle planning is done at the lowest possible level*. The tactics of the maneuver units determine the purpose, size, and type of obstacle required. Obstacles *enhance combat power*. *Weapon systems are not sited to cover obstacles with fire, rather obstacles are sited to strengthen weapon*

systems and unit combat effectiveness.

Proper siting of obstacles is dependent upon weapon placement and characteristics, the battlefield terrain, and the type of obstacles available.

Reinforcing obstacles are categorized as conventional or dynamic.

CONVENTIONAL OBSTACLES include:

- Road Craters
- Blown Bridges
- Abatis
- Minefields
- Antitank Ditches
- Wire

Conventional obstacles are normally planned and emplaced before the battle begins because of the on-site effort in manpower/equipment, materials, and time. Emplacement of obstacles will continue *during* the battle but will be deeper in the main battle area (MBA) and used to strengthen the defense. They could also be employed during the offense on flanks and in economy of force areas.

To reduce interference with the division's mobility, obstacles may be prepared but not executed, i.e., explosive charges are not detonated and minefield gaps are not closed without permission from the tactical

commander responsible for the sector. Obstacle plans and demolition firing orders will specify the appropriate releasing authority.

DYNAMIC OBSTACLES are the Family of Scatterable Mines (FASCAM). They have a specific active life before self-destruction; therefore, scatterable mines do not present permanent obstacles which later can impede our forces' mobility. They may be delivered by helicopter (M56 Antitank/Antivehicular) and artillery (artillery delivered antipersonnel mine). Their employment is planned before the battle; but since they have a faster emplacement response and a specific active life, *employment during the battle predominates*. The M56 system has been procured only for the European Theater. Chapter 6, Future Developments, provides descriptions of FASCAM systems that will be fielded after 1980.

The type of minefields are depicted in the following table:

FASCAM CHARACTERISTICS

SYSTEM	DELIVERY	APPROXIMATE MINEFIELD SIZE
M56	Helicopter (UH1H)	20x(100 to 300) meters per sortie
ADAPM*	155MM HOW	350x350 meters per 2 rounds

*ADAPM: Artillery delivered antipersonnel mines.

Survivability is development of protective positions.

3 SURVIVABILITY

Engineer units provide the specialized equipment and expertise to assist forward division units in digging in. Priority effort goes to maneuver units.

Defilade/protective positions improve the survivability and effectiveness of friendly forces.

Normally, positions will be expedient in nature, providing only side and frontal protection against direct and indirect fire weapon systems. Critical supplies such as ammunition and POL can also be protected by earth berms or slot excavation techniques.

The greatest number of protective positions are expected in the defense. With the exception of the most forward defilade positions, the majority of work is accomplished by nondivisional engineer units.

4 GENERAL ENGINEERING

General engineering missions are those in the brigade rear and division areas that do not contribute directly to the committed maneuver units.

The *division engineer* battalion is organized to fight with the committed maneuver brigades. *Corps engineer* assets provide the primary capability to accomplish general engineering missions in the division area.

GENERAL ENGINEERING missions:

Improve and maintain essential combat and main supply routes.	Develop forward support areas for rearming/refueling.
Prepare field and air defense artillery positions.	Replace assault or blown bridges with tactical bridging.
Repair airfields, build protective positions, and develop minimum essential logistics areas.	Provide water.
	Conduct terrain studies.

Division requires corps support for Atomic Demolition Munitions (ADM) emplacement, major river crossings, and general engineering missions.

Corps engineer units support the division for the emplacement and firing of all ADMs, float bridging requirements in excess of 144 meters, all panel bridging assets, and general engineering support. Operations planning must consider these deficiencies in the division engineer capabilities.

The emphasis on arm, fuel, and fix forward requires increased general engineering effort to support the division combat service support system.

The extended range and high density of Threat weapon systems will increase the quantity of damage in the rear areas. General engineering missions such as protective construction and repair of key command and support facilities will take on increased importance.

INFANTRY COMBAT MISSION

Engineer units move to and from the work site and provide their own security and protection.

The infantry mission, however, is beyond the scope of normal engineer operations. The engineers must be ready to fight as infantry. Engineers have knowledge of basic infantry tactics and are prepared to reorganize to accomplish this mission.

A mission of the engineer system is to carry out infantry combat missions when required.

Implementation of this mission is the *decision of the DIVISION COMMANDER*. Such occasions are rare and more probable in the defense than the offense.

Can the division operate effectively without engineer support? And for how long?

Will the division get the job done without using the engineers in infantry combat missions?



Because of the consequences of the loss of future engineer support, the division commander commits engineers in an infantry role only when absolutely necessary.

They'll need support: more antiarmor weapons, FOs, mortars, and logistics.



The dispersion of engineer missions throughout the division area may dictate employing the engineer companies in infantry combat operations, rather than the entire battalion as a unit.

The engineer unit functions best as infantry when given a limited area mission and unit integrity is maintained.

The ability of the division engineer battalion to perform combat engineer tasks is severely limited when the unit is fighting as infantry.

When conducting infantry combat missions, the engineer battalion reorganizes. It separates into forward and rear echelons.

Men and equipment not required for the mission become rear echelon. The forward echelon has less combat power than an infantry battalion because it has fewer personnel, fewer small arms and equipment, fewer supporting weapons, and comparatively limited infantry training. This element should be augmented with indirect fire support, forward observers, tanks, and additional antitank weapons.

COMMAND AND CONTROL

Judicious use of engineer resources is mandatory to satisfy the division requirements. Engineer requirements in the division area greatly exceed engineer assets. The division derives the greatest benefit from the mobility/countermobility/survivability system when engineers are actively included in the *planning and execution* of an operation.

The engineer battalion commander is also a special staff officer responsible to the division commander for *all engineer related matters*.

The *assistant division engineer (ADE)* is the engineer point of contact at division. He provides day-to-day coordination with the division staff on matters of engineer concern and assists in planning engineer support for division operations. His normal day-to-day association is with the G3 staff element, yet he is available to the entire division staff.

The ADE is located at the division main command post and relocates to the TAC CP as required.

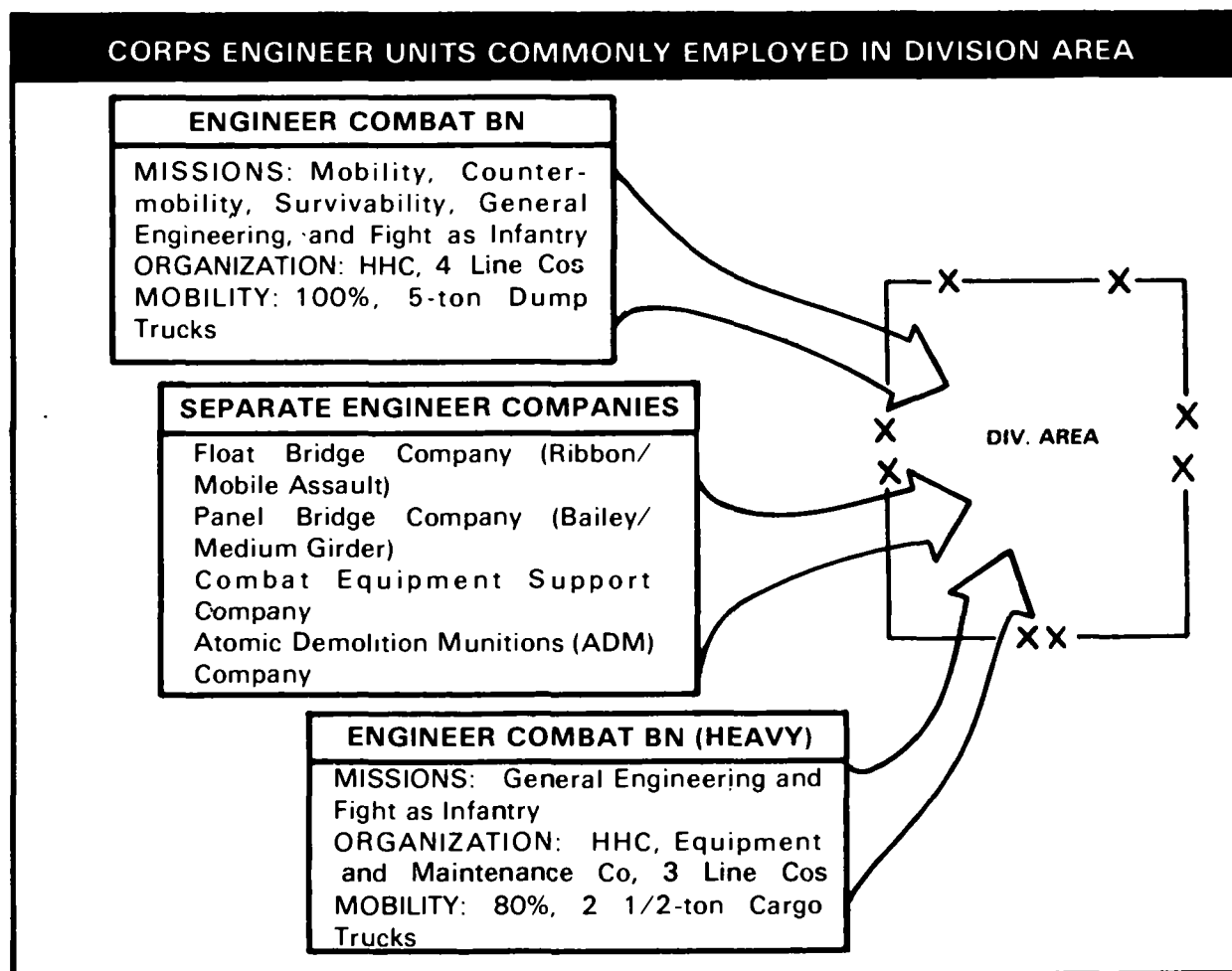
The division engineer and his staff *coordinate all engineer-related actions* to insure division requirements are met. Actions beyond the capability of the division are obtained through coordination with corps. The concept of employment requires three corps combat battalions and one combat battalion, heavy in the corps area for each committed division. Two corps combat engineer battalions are normally located forward in each committed division's area. Corps engineers are normally in direct support (DS) or general support (GS) to divisions. They may be attached to or placed under operational control of the divisions based on the span of control or other tactical considerations.

The command and control method is based on the corps commander's overall tactical plan and his assessment of each division's contribution to that plan. The corps engineer advises the corps commander in making this decision.

Whatever command relationship may be established between corps engineers and the division, *three cardinal principles apply for engineers operating within the division area of operations*:

- 1 The thrust of engineer effort is forward, with the corps engineer elements habitually working as far forward as the brigade areas.
- 2 The concept of normal association is followed in that the same engineer units, as a matter of normal procedure, operate with the same maneuver elements.
- 3 All engineers operating within the division area of operations are coordinated or directed by the division engineer as the single engineer point of

contact for the division commander. Within the brigade areas, the normally associated divisional engineer company commanders (brigade engineers) normally perform this coordinating or directing function for the division engineer and act as the single point of contact for brigade commanders. If the division engineer determines that the number of engineers operating within the brigade area exceeds the coordinating capability of the company commander, he may form a task force control structure to carry out this function. In this case, the task force commander is given the mission and is allocated the necessary staff (division and supporting engineers contribute) by the division engineer to act as the brigade engineer.



The traditional relationships between the division engineer and corps engineer units operating within a division area of operations is unique within the combined arms team. It is an historically tested and proven method of retaining the flexibility offered by the normal DS/GS relationships between corps engineers and divisions while at the same time insuring that engineer effort in the division area is coordinated with and responsive to maneuver unit commanders.

The division engineer is the division commander's single point of contact for engineer support in the division area of operation.

The control of engineer activities in the division area can be subdivided into two distinct categories: support to the committed brigades in the forward battle area and general engineering accomplished in the brigade and division rear areas.

Control of Engineer Support to Brigades

Each committed brigade will have one division engineer company **direct support**. When requirements exceed the capabilities of one company, additional resources from either the division engineer battalion or supporting corps engineer units are placed in support of the brigade under direction or coordination of the DS engineer company. This arrangement provides the brigade commander continuity and a centralized single source management for engineer matters.

At brigade, the engineer company commander is the brigade engineer and coordinates or directs all engineer activity in support of the brigade.

The brigade engineer tasks his platoons or elements of other engineers to work in support of maneuver battalions or battalion task forces.

Engineers are **attached** to maneuver units only when time and/or distance factors **prohibit** control by the parent engineer unit. This may be the case in a movement to

contact, reconnaissance in force, or in covering force and independent operations.

Control of General Engineering

General engineering can be controlled by specific task assignment (MSR maintenance or repair between points A and B), work area (division main CP), or engineer workline (provide all engineer support between the division rear boundary and engineer workline Zebra).

Engineer units, including corps assets, not in direct support of brigades are given general engineering missions.

Engineer support is tailored to fit requirements: direct support provided to committed brigades, and general support under division engineer coordination — all responsive to the tactical commander's needs.

Reconnaissance and Terrain Activities

Engineer reconnaissance and terrain activities encompass the entire combat area. The engineer tasks his S2 for the detailed reconnaissance and planning. Reconnaissance that cannot be accomplished by recon teams of the battalion intelligence section is assigned to line companies. Route, stream, bridge, obstacle, air landing facility, and support area reconnaissance are common tasks.

Reconnaissance or terrain expertise beyond division capabilities is provided by corps battalions or corps terrain analysis units. The division direct support element from the theater army topographic battalion is collocated with the all-source production section of the combat electronic warfare/intelligence (CEWI) battalion. This terrain element can provide single copy rough overlays quickly and can cause mass reproduction of map overprints or overlays by tasking the cartographic company in DS of the corps. The engineer system is also a user of the DIVISION INTELLIGENCE

SYSTEM. Threat order of battle, war damage to key facilities, and lines of communications are examples of information requirements of the engineer.

Engineer reconnaissance for committed brigades is critical. Data about enemy engineer capabilities provide indications of possible actions and his capability to emplace/remove obstacles. This information is important not only to the maneuver units but also to the engineer in determining support type and mix.

The engineer reconnaissance and terrain analysis capabilities available to the division are used most effectively when the engineers actively participate in the planning of division operations.

The impetus is to employ *engineers as far forward as possible.*

Division engineers allocate organic engineer units and systems forward to engineer company commanders based on terrain and the tactical deployment of maneuver elements by the division. *Division battalion assets may be reapportioned at any time among organic companies as the tactical situation demands.* The division engineer directs the efforts of supporting engineers in the division's area of operations (AO), to include the allocation of support to the forward battle area, as required.

Engineer company commanders (brigade engineers) allocate engineer resources, assigned and supporting, to platoon commanders. *Company commanders may reapportion total assigned or supporting company assets at any time among platoon commanders as the tactical situation demands.*

Platoon commanders use the engineer system to fight as required by battalion task force commanders. Depending on the resources allocated to them by the company, they may direct the efforts of supporting engineers.

CONCEPT OF ENGINEER EMPLOYMENT

Normal association between division engineer units and division maneuver elements strengthens the combined arms team concept and permits familiarity between supported and supporting units' needs, capabilities, SOPs, communications,

and plans which is necessary for responsive and effective system employment. Whenever possible a maneuver brigade will be supported by the same division engineer company and a battalion task force by the same engineer platoon.

The engineers in the offense provide the combined arms team with the capabilities to maneuver over existing terrain and obstacles. In the forward tactical areas the engineers accomplish this by spanning gaps, bridging rivers, and by breaching or constructing bypasses around minefields, fortified positions, and other obstacles. The preparation of overwatch battle positions and emplacement of tactical minefields on exposed flanks are also engineer tasks enhancing maneuver force survivability in the forward area. In the rear areas, engineer maintenance of supply routes becomes a primary function.

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Section I

INTRODUCTION

PURPOSE

OFFENSIVE OPERATIONS are undertaken to:

Destroy enemy forces.

Gain control of key terrain.

Deprive the enemy of resources, demoralize him, and destroy his will to continue the battle.

Deceive and divert the enemy.

Develop intelligence.

By taking the offensive, attacking forces gain the initiative, carry the fight to the enemy, fight in enemy positions, and seek decision on their own terms.

CONCEPT OF THE OFFENSE

Decisive results are achieved through offensive actions. The attacker seizes the initiative, sets the tempo of battle, and imposes his will on the enemy. The defender is forced to fight and react in places and at times of the attacker's choosing.

Although the required combat power ratio will vary, the goal of the attacker is to achieve a ratio of at least 6 to 1 at the point of decision. The attacking force increases combat power by capitalizing on surprise, security, speed, and deception.

Once the attack starts, there is no letup. Enemy strongpoints are bypassed and engaged by follow-on forces. Enemy positions that cannot be bypassed are attacked from the line of march without hesitation. Every effort is made to destroy enemy combat support, combat service support, and command and control facilities.

Commanders at every echelon are positioned well forward where they can see, feel, and control the battle. Staffs provide commanders with essential information.

FUNDAMENTALS

There are six fundamental considerations in offensive operations:

- 1 See the battlefield.
- 2 Concentrate overwhelming combat power.
- 3 Suppress enemy defensive fires.
- 4 Shock, overwhelm, and destroy the enemy.
- 5 Attack deep into the enemy rear to destroy his system of defense.
- 6 Provide continuous mobile support.

To understand the complete nature and full extent of the engineer's role in the offense, the engineer must be familiar with these fundamentals as well as the tactics and techniques employed by the tactical commander. This will enable the engineer to anticipate required engineer tasks and fully support the tactical plan.

1. **See the Battlefield.** Knowledge of the enemy is prerequisite to success. The commander must know how the enemy intends to defend. The commander planning an attack must know as much as possible about:

The number, type, location, and strengths of opposing units.

The capabilities and vulnerabilities of weapons in enemy hands, and how he normally employs these weapons.

The morale and physical condition of the enemy force.

To acquire this information, the commander must expect to launch intelligence, reconnaissance, or even combat operations to locate main enemy forces and weapons, and identify areas where the enemy is weak or can be weakened.

Engineers help the tactical commander "see the battlefield" by providing information or intelligence on obstacles, field fortifications, camouflage, maneuver routes, area trafficability, and hydrography, to include locations and suitability of river crossing sites.

2. **Concentrate Overwhelming Combat Power.** To succeed in the attack, the commander must concentrate on a narrow front at a site where the enemy is weak. If no enemy weakness can be found, it can be created by the attacker using surprise and deception as well as the full mobility of the force. The concentration of forces for the attack is a race for time.

Engineers enhance the mobility of the maneuver forces by spanning gaps and by breaching or bypassing minefields, obstacles, and fortified positions. They also counter the enemy's mobility by laying mines and creating obstacles on the flanks of the attack.

3. **Suppress the Enemy's Defensive Fires.** As forces concentrate, they become increasingly vulnerable to enemy fires. Therefore, suppressive strikes against enemy weapons must be of such intensity and duration as to destroy or substantially degrade the effectiveness of enemy weapons in the critical area. Coordination of suppressive fires with the maneuver of forces along covered and concealed routes is the essence of success.

4. **Shock, Overwhelm, and Destroy the Enemy.** Once the attack is launched, the commander coordinates action to insure maximum speed, surprise, and violence. The attack must be narrow and in depth. Once the initial attack takes effect on the enemy, he must be allowed no letup. The pace of new attacks delivered on the enemy should exceed

his ability to react so, as the offensive progresses, teamwork among enemy forces deteriorates and his units lose cohesion. Foremost, advancing units must bypass points of resistance, striking deep and fast.

Engineers are part of the combined arms team that overcomes terrain to keep the advancing units moving. They provide information or intelligence on terrain. This information enables the commander to move his forces along routes offering cover and concealment from enemy observation and fires. As previously stated, engineers breach or bypass minefields, obstacles, and fortified positions, span gaps, and protect the flanks of the attack by laying mines and creating obstacles.

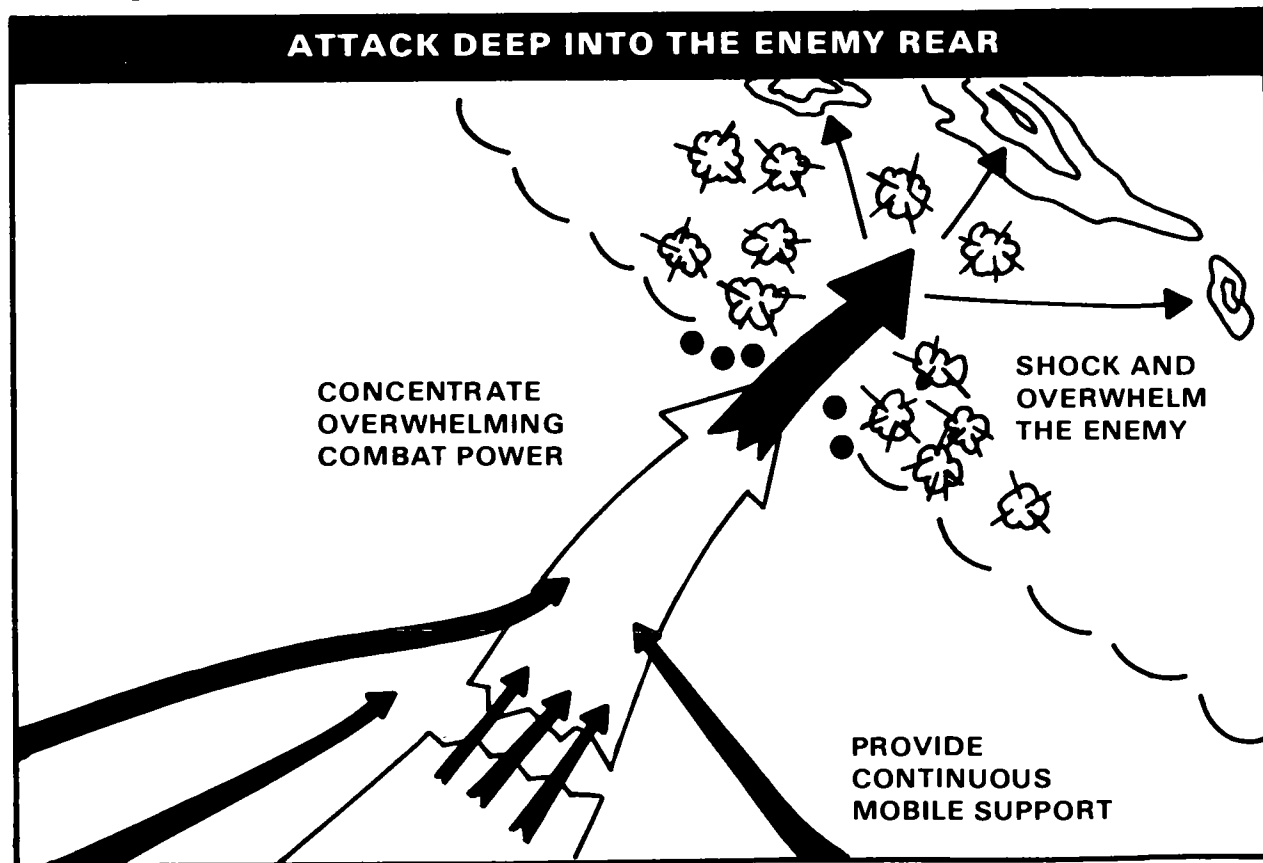
5. Attack the Enemy Rear. Once enemy forward combat elements have been penetrated, the attacker should seek out the enemy rear, destroying headquarters, combat support, and combat service support units. Successful attack into the enemy's rear will often force him to abandon the advantages of prepared defensive positions,

and to commit his maneuver units to hasty countermoves where they are significantly more exposed.

In addition to doing those tasks that keep the maneuver forces moving into the enemy's rear, engineers assist in the destruction of strongpoints, defensive positions, and combat service support facilities which weaken or destroy the whole system of defense.

6. Provide Continuous Mobile Support. A successful attack requires continuous combat support and combat service support to sustain the weapon systems essential for the momentum of the attack. Combat support and combat service support elements must carefully plan movement to keep pace with the maneuver elements, and they must work together as a team.

Engineers assist the forward movement of fuel and ammunition needed by the maneuver elements to sustain the weapon systems by opening and maintaining essential supply routes and landing zones.



GENERAL**Section II
THREAT DEFENSE**

A sound knowledge of Threat force — his intentions, capabilities, and tactics — is of vital importance in the planning and conduct of any operations for it is the Threat's deployment and conduct of the defense that affect the advancing unit's offensive actions.

Threat defensive operations are characterized by stubborn defense in belts of prepared positions, with mobile reserves retained as counterattack forces. The Threat considers the defense as a temporary expedient to:

Economize forces.	Inflict heavy losses upon an opponent.
Gain time for offensive concentration in other areas.	Consolidate captured objectives.
Repel a superior attacking force.	Cover a withdrawal.

FUNDAMENTALS OF THREAT DEFENSE

The Threat adheres to the following *fundamentals* when conducting the defense:

Provide defense in depth.	Concentrate on destruction of attacking tanks.
Develop mutual support between weapon systems.	Take advantage of terrain, obstacles, and firepower to create armor killing zones.
Hold in the main defensive belt at all costs.	
Continue resistance if bypassed.	Retain strong mobile antiarmor reserves to counterattack against penetrations.

TYPES OF THREAT DEFENSE

The Threat uses two types of defense — the **Hasty Defense** and the **Deliberate Defense**.

The Hasty Defense. The hasty defense is adopted when Threat offensive action has been suspended for what is expected to be a

very short period of time. This type of defense is characterized by little engineer preparation of defensive positions.

The Deliberate Defense. The deliberate defense is organized in successive belts designed to provide depth to the defended area. Each defense belt consists of a series of mutually supporting, self-sufficient company and battalion-size strongpoints echeloned in depth. Strong, mobile, tank-heavy reserves are retained as a counterattack force. Obstacle belts are constructed both forward of and within each defensive belt in order to impede the advance of opposing forces and canalize them into planned killing zones. Normally, they consist of a *Security Zone* and a *Main Defense Belt* with a second and third defensive belt at echelons above division.

Security Zone. The purpose of the security zone is to halt or delay the attacking unit by forcing it to deploy before reaching the main defense belt. It is at least deep enough to prevent the delivery of fire on the main and second defense belts with divisional weapons. This zone normally extends up to 30 km forward of the main defense belt.

Forces in the security zone are composed of units from divisions occupying the main defense belt and from higher echelon forces. Their missions are to protect the main defense against surprise attack, conduct counterreconnaissance, conduct counterbattery fire on enemy artillery positions, deceive the enemy as to the location of the main defense and prevent the clearing of obstacles. Threat engineers assist the combat elements in preparing defensive positions in the security zone to resemble as closely as possible the strongpoints of the main defense belt.

Main Defense Belt. This belt is the backbone of the defense and is designed to stop and destroy attacking forces. The main defense belt can be up to 15 km deep. It is manned preferably by motorized rifle units. Within this belt are those forces necessary to conduct the defense, including tank, artillery, antitank, radioelectronic combat, and air defense units; division reserves; and the division main and alternate command

posts. Every effort is made to take advantage of the natural defensive strength of the terrain.

Advancing units, particularly the engineers, should keep the following in mind concerning how the Threat defends.

Antitank defense is a major aspect of the total defensive operation. Antitank defenses include:

Antitank strongpoints astride tank approaches.

Primary and alternate firing positions prepared for occupation by tanks and antitank reserves.

Planned artillery concentrations.

Extensive use of antitank mines and other obstacles.

Use of artillery, antitank weapons, air defense artillery, tanks, and assault guns in direct fire on tanks that have penetrated the defense.

THREAT ENGINEER SUPPORT

General. Threat defensive operations are characterized by the extensive use of prepared positions and large scale employment of mines and other obstacles.

The *primary mission* of the Threat engineers in the defense is to:

Assist the combat elements in preparing defensive positions.

Supervise and assist in the preparation of obstacles.

Assist in maintaining the mobility of the reserves.

Threat combat engineer units are found at regiment and division. (See Appendix C for complete details on Threat engineer

organizations and equipment). They are equipped with the same small arms, tactical communications, and in many cases, combat vehicles as are the combat arms units. They have the capability to fight as infantry. Above division, there are large specialized engineer organizations (regiments and brigades). Such organizations include construction, bridging, assault crossing, mapping and surveying, and pipeline construction units.

Reconnaissance. Threat engineers perform a detailed reconnaissance and analysis of the battlefield. This analysis is the basis for their defensive planning.

Field Fortifications. Emphasis is placed on elaborate trench systems and heavy fortifications when time permits. To construct them rapidly, Threat engineers are equipped with mechanical trench diggers, explosive excavators, and other special engineer equipment. All division defense plans include priorities for the construction of defensive positions. Threat engineers are responsible for planning defensive field fortifications and operating their special equipment; however, actual construction work is done by combat units. Many types of attachments are available for tanks to do the work of tractors and bulldozers, and there are a number of specialized engineer vehicles on the T-54/55 tank chassis.

Obstacles. The Threat makes extensive use of mines in all operations, but especially in the defense. Mines are employed against all types of targets. Antitank (AT) minefields are laid with a minimum of one AT mine per meter of frontage. Three rows of mines are required for a minimum density, as the Threat places AT mines on the average of 3 meters apart. In the defense, AT minefields are placed across likely tank approaches about 400 meters in front of the forward defenses and across approaches into areas occupied by division artillery elements. Threat forces may lay mines on the ground rather than burying them when time is a factor.

Mines are laid by hand or by machine. The Threat engineer has both a towed PMR-60

and an armored self-propelled tracked minelaying device. Self-propelled tracked mine layers are located in regimental engineer companies and division engineer battalions.

Controlled chemical and high explosive (HE) mines are placed in gaps in the minefield to allow friendly units to freely traverse the minefield. Delayed-action mines are used in areas where enemy concentrations might take place, such as railroads, destroyed bridges, and probable assembly areas.

Most antitank and antipersonnel land mines are set off by tripwire or pressure detonated fuzes. Special purpose fuzes, such as magnetic, delayed-action, vibratory, and unextractable fuzes, are occasionally used in their mines to cover withdrawals and to harass attacking forces.

Obstacles other than minefields are placed to cover all possible enemy avenues of approach into defensive areas. Threat engineers are known for their resourcefulness in the employment of field expedient obstacles. Examples are the use of antitank ditches, tank traps, abatis, barbed wire, and chemical and radioactive contamination.

THREAT VULNERABILITIES

Threat forces are extremely vulnerable when halted by a successful defense. It is often difficult for the Threat to organize for defense on terrain where an attack grinds to a stop. Equipment is not dug in or protected, and weapons may not be positioned for mutual support. At the moment the Threat force's attack is halted, opposing mechanized and armored forces, with their mobility and fire power, have a distinct advantage to assume the offense.

If the Threat's attack has faltered, it is likely that reserves have already been committed and no fresh troops are available to fill gaps. Further, the same effects of casualties, destruction of material, and lowered morale that cause the attack to fail make reorganization, consolidation, control, and coordination for defense extremely difficult.

Threat battalion commanders must await regimental approval of defense plans. This delay can lead to carelessness among Threat forces at a critical time.

Consequently, timely offensive operations launched against an enemy forced to stop and prepare a hasty defense have a much higher probability for success than those conducted against an enemy in a deliberate defense.

Even in a deliberate defense, however, Threat forces may become vulnerable when advancing units are able to disrupt completion of the Threat's defensive plans. The extensive use of prepared positions and obstacles in the Threat's deliberate defense requires much time and resources (men, equipment, supplies) to construct. Actions aimed at disrupting the movement of these resources on the battlefield could cause him delays in completing his defensive positions in the depth planned. Attacks planned around the six basic fundamentals of offense should enable the tactical commander to detect and exploit these enemy weaknesses.

Section III

THE CONDUCT

OF

OFFENSIVE

OPERATIONS

The type of offensive operation is important because it transmits the intent of the commander to his subordinates and describes the general concept of operation. Therefore, commanders at all levels must understand what is intended in each type of operation.

The four major types of offensive operation that may be conducted by divisions or brigades are:

1	MOVEMENT TO CONTACT
2	ATTACK (HASTY AND DELIBERATE)
3	EXPLOITATION
4	PURSUIT

Additionally, there are other offensive operations that may be described as *limited objective operations* or as *deception operations*:

LIMITED OBJECTIVE OPERATIONS
Reconnaissance in force
Raid
Spoiling attack
DECEPTION OPERATIONS
Feint
Demonstration
Ruse

1 MOVEMENT TO CONTACT

A movement to contact is conducted to gain or reestablish contact with the enemy. It is used when the enemy situation is extremely vague and the division commander is not certain of enemy dispositions or strengths. It provides for early development of the situation in order to gain an advantage over the enemy prior to decisive combat.

In a movement to contact, most of the force is uncommitted. This avoids premature commitment or delay and permits the situation to be developed with the smallest possible force. The division advances on a broad front using the techniques of the tactical column or approach march.

The primary elements for a movement to contact are the covering force, advance guard, flank guard, and the main body. *Engineers may be teamed with any or all of these elements.*

Covering Force. The covering force develops the situation and prevents unnecessary delay of the main body. It must

be strong and mobile and normally will operate well forward of the main body. Normally, it is reinforced with attack helicopters, field artillery, air defense artillery, and engineers.

Engineers in the Covering Force. Engineers normally will be *attached* to the covering force because of time and distance factors which limit effective control by the parent engineer unit. When a brigade is operating as the division covering force, it usually has an engineer company and an assault bridge element attached. The priority of engineer tasks will be controlled by the tactical commander of the covering force with recommendations from the senior engineer in the covering force.

Engineers in the covering force (to include engineer reconnaissance teams) should be located well forward to aid the movement of the force. One of the two CEVs in the combat engineer company should be located with the leading element of the covering force. The other CEV should remain under the control of the engineer company commander for deployment to the front or flanks as required. In addition, the need for AVLBs and breaching devices/explosives must be planned ahead of time.

The engineer must be prepared to carry out a variety of engineer tasks. *Hasty breaching/crossing of obstacles* will be required when bypassing them is not feasible. Engineers are concerned also with *reconnoitering* the planned axis of advance.

Hasty Breaching/Crossing of Obstacles. Obstacles are classified as either EXISTING or REINFORCING. Existing obstacles are those natural and cultural restrictions to movement that are a part of the terrain when battle planning begins. Reinforcing obstacles are constructed, emplaced, or detonated to tie together, strengthen, and extend existing obstacles. The table on foldout 3-9 shows the classification of obstacles.

CLASSIFICATION OF OBSTACLES			
EXISTING		REINFORCING	
Natural Drainage Features ----- Lakes, bays Rivers, streams Swamps, marshes, bogs	Cultural Manmade lakes ponds, canals and canalized streams Paddy fields	Conventional Flooded areas	Dynamic
Soil and Rock ----- Soft, stocky, slippery Cliffs, outcrops Boulders	Agriculturally-derived softness Quarries, cuts in rock Pits and open-pit mines	Craters, and crater lips and throwout Strewn objects Dragons teeth	Remotely-created craters
Surface Features ----- Slopes Mountains Hills	Embankments, cut and fills Mine tailings Terraces Dams	Craters Ditches and cuts in embankments	Remotely-created craters, ditches
Vegetation ----- Forests Jungle	Cultivated forests Hedgerows	Log obstacles Abatis, wire entanglements	Tree blowdown
	Built-up Areas ----- Buildings Structures Walls and retaining walls Fences	Demolished buildings, rubble Falling block Wire obstacles	Demolished buildings rubble (artillery, air). Falling block
	Road/RR Net	Demolitions	Demolitions
		Mines	Mines, Scatterable Mines
			Contamination
		Contamination	Smoke

Obstacles which cannot be bypassed are breached or surmounted. The method employed is determined by:

The type of obstacle.
The allowable time.
The equipment available. Breaching usually involves removal or destruction by demolition. Surmounting an obstacle may require bridging or ramps.

The location of the passage(s) is determined by:

The tactical plan.
Terrain.
Enemy position.
The extent of the obstacles.

Road gaps which cannot be bypassed are hastily repaired or bridged. River crossings are primarily *hasty* crossings. If bridges cannot be secured intact, a hasty crossing is made on a wide front capitalizing on organic assault bridging, amphibian characteristics of armored carriers, organic airlift capability, and improvised means employing demolitions, nonstandard bridging materials, or earthfills emplaced by dozers or CEVs.

Engineer Reconnaissance. Engineer reconnaissance during the movement to contact is performed by reconnaissance teams from the battalion intelligence section accompanying the covering force. Reconnaissance that cannot be accomplished by battalion reconnaissance teams is assigned to line companies.

Reconnaissance teams provide the division engineer with early, reliable engineer intelligence of the area over which the division is to advance. Routes of advance are thoroughly examined for:

Serviceability.
Type.
Condition.
Location of critical points and bypasses.
Alternate routes.
Mines.
Condition and types of bridges.

Route information is forwarded to higher headquarters as it becomes available.

The reconnaissance teams make an *estimate of engineer tasks and available engineer materials*. Estimates of tasks to be completed and time factors are continuously forwarded to highway traffic headquarters.

The on-the-ground reconnaissance must be supplemented by *air reconnaissance, map and aerial photograph studies*, and *terrain studies* from the division terrain element and other elements of the division and corps.

It is essential that this reconnaissance is made prior to the movement, since the information gained provides a basis for the estimate of engineer troops, supplies, and equipment necessary to support the operation and for the selection of routes and the formation of traffic control plans.

Advance guard. The advance guard normally is furnished and controlled by the leading elements of the main body. Its purpose is to assist the covering force and to insure the uninterrupted movement of the main body.

Engineers in the Advance Guard. Engineer elements accompanying the advance party of each leading brigade usually are placed in *direct support* of the

guard force. The priority of engineer effort will be controlled by the senior engineer in each guard force.

As with the covering force, engineers (to include reconnaissance teams) in the advance guard should be located well forward to aid the movement of the force. The point engineers (normally a squad) teamed with the lead element of the advance guard are reinforced with special items of equipment such as the CEV, AVLB, and demolition breaching devices, in addition to mine detectors and probes. The remainder of the advance guard engineers - with tools, transportation, and equipment - moves with the advance guard command group. The advance group engineers maintain contact with the point and leave work parties at vital points where the need for engineer assistance exists or is anticipated. These parties rejoin their units upon completing their tasks or upon being relieved by engineers from the main body.

Engineer reconnaissance elements accompany the advance party of each leading brigade to provide the unit engineer with timely notification of forward engineer requirements. Likely avenues of approach are closely examined for possible enemy use of mines, obstacles, and defending weapons.

Within their capabilities, the advance guard engineers reduce all obstacles which have been left or only partially breached by the covering force. They must expect to encounter obstacles of all types and therefore should supplement their basic load with demolitions (TNT, C4, M118, etc.), line charges, and bangalore torpedoes. They:

Detect, open, and mark lanes through minefields.

Neutralize critical obstacles.

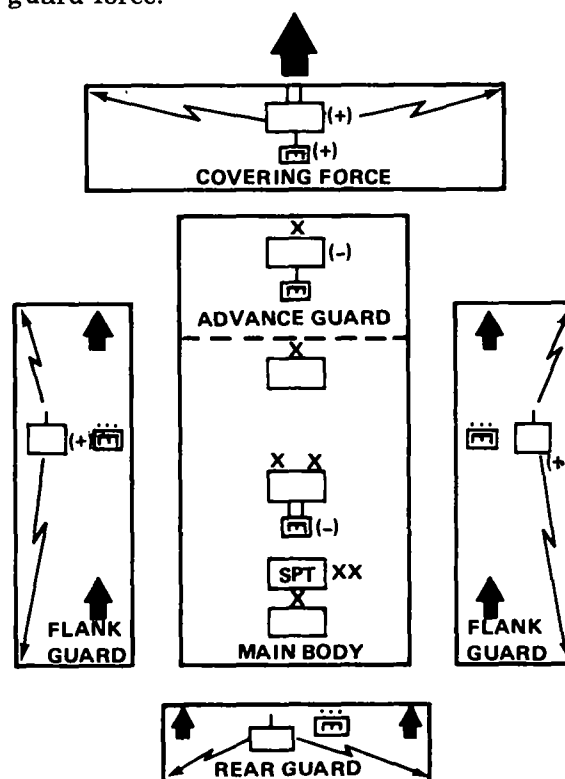
Relay information on required forward engineer tasks to the division engineer.

Removal or breaching of complex obstacles may require additional engineer troops and equipment which are moved forward from the main body. It is important, however, that

only *minimum essential* tasks be done.

Flank and Rear Guards. Flank and rear guard forces protect the main body from ground observation, direct fire, and surprise. Flank and rear guard units may operate under division control or they may be controlled by main body brigades.

Engineers in the Flank and Rear Guards. In addition to the advance guard, engineer elements from the "brigade" engineer company usually are placed in *direct support* of the flank and rear guard forces. The priority of engineer effort will be controlled by the senior engineer in each guard force.



The engineer element must be prepared to assist the flank and rear guard forces in blocking enemy avenues of approach into the division's flanks and rear. To counter the enemy's movement, they must expect to develop obstacles that are reasonably simple and quick to employ such as craters, minefields, and demolished bridges. Therefore, the engineer should plan to supplement basic loads of explosives and mines with additional demolitions, to include M180 cratering devices, and antitank and antipersonnel mines.

Main Body. The main body contains the bulk of the division's combat power. It is organized for immediate commitment against major enemy forces or for exploitation of disorganized, surprised, or weak enemy forces. At division level, the movement to contact is normally conducted in multiple columns to take advantage of the available road net, and to prevent a smaller enemy force from conducting an effective delay.

When enemy resistance is encountered that is beyond the capability of the covering force and the advance guard, the division commander commits forces from the main body to maintain the momentum of the advance. When units from the main body are committed, the movement to contact ceases.

Engineers in the Main Body. In the main body, each committed brigade normally will have one divisional combat engineer company in *direct support*. The company commander is the brigade engineer. The brigade engineer recommends the allocation of engineer units based on the engineer estimate, current requirements, and available engineers.

Elements of the "brigade" engineer company (less any elements in direct support of the advance guard and other security forces) are positioned in the advancing columns of the main body so that maximum flexibility and communication with the security forces are maintained. They:

Reinforce or replace engineers in the security forces.

Improve on the work of the covering force or advance guard engineers.

The company headquarters normally moves with the brigade command group.

The remaining elements of the division engineer battalion (HHC, the bridge company, and uncommitted line companies, if any), will follow the committed brigade. Any nondivisional engineer units, either attached to, or in direct support of, the division, and not committed to the covering force or the security forces, will also follow the committed brigade. Engineer elements

committed to the rear security force normally will come from these units.

2 ATTACK

Attacks may be launched from a movement to contact; or by passing other forces through a defending force; or, they could be launched from defensive positions while the division is in contact with the enemy.

Hasty Attack. It may be difficult to determine when the movement to contact ends and the hasty attack begins. If, during a movement to contact, the division encounters the main enemy defensive positions and locates a point where the enemy is weak, surprised, or poorly organized, a hasty attack is conducted from the line of march without hesitation or major preparation. This is the optimum situation because the division maintains its momentum and is able to strike quickly into the enemy's rear before his defenses become organized.

Deliberate Attack. When the division encounters a well-organized enemy defense in prepared positions, more combat power and time will be required to overcome the defensive system by conducting a *deliberate attack*.

When a major effort is required, the division commander uses all sources of intelligence to see the battlefield clearly. He focuses efforts to locate a lightly held and assailable flank, a weak point in enemy defense, or any other exploitable enemy vulnerability.

The attack is launched with overwhelming violence, speed, and surprise to shock the enemy. Every effort is made to overrun or bypass enemy strongpoints that could slow the momentum or inhibit a quick breakthrough. The enemy is denied an opportunity to concentrate forces against the division. Close air support for the attack is timed to destroy and immobilize forces in the second defensive belt and enemy reserves. Reserves are committed to maintain the momentum of the attack, widen the point of penetration, destroy bypassed enemy forces, thwart counterattacks, and exploit where the situation permits.

Engineers in the Attack. In part, the role of the engineers in the attack resembles their role in the movement to contact. Engineers are placed in direct support of the combat maneuver elements. They:

Improve the movement of combat maneuver elements and supporting units by breaching, surmounting, or bypassing obstacles.

Assist in the assault of strong-points.

Increase flank protection by creating obstacles on avenues of approach to the flanks.

Enable the crossing of water obstacles.

Establish and maintain routes of advance for combat and combat support units and for essential supplies.

Establish and operate water points.

Assist in organizing captured ground against counterattacks.

Provide technical assistance in camouflage and combat deception measures.

Reconnaissance. Reconnaissance is required both before and during the attack.

Before the attack begins, a preliminary *engineer study* is made of the terrain, bridges, routes of advance, and reinforcing battlefield obstacles such as minefields, tank traps, and emplacements. The techniques of attack and the requirements for engineer breaching personnel, supplies and subsequent reconstruction are based on this study.

Information for the study may come from various sources, of which ground reconnaissance is the most satisfactory. For areas beyond the reach of ground reconnaissance parties, information must come from aerial photographs and other sources. Ground reconnaissance before the attack should, if possible, investigate obstacles in front of and on the flanks of the enemy position.

Special reconnaissance missions are assigned by the battalion intelligence officer. On the basis of this reconnaissance information, engineer operational plans are made and means are provided to assist in maintaining the momentum of the attack.

The reconnaissance parties seek to determine the positions of the obstacles which are best adapted for breaching operations, either because of their weakness or because they are not well covered by fire. *Normally, reconnaissance is done by the troops who are to breach the obstacles.*

Reconnaissance parties are given definite routes and areas, carefully instructed in their duties, and when possible, rehearsed. They must operate in a manner that will not compromise planned operations. Personnel are briefed on all available information.

During the attack, the reconnaissance teams from the engineer battalion headquarters continue their general reconnaissance, closely following the forward engineer companies. They pay special attention to the routes of advance.

Engineer companies teamed with brigades make continuous reconnaissance of routes of advance, particularly the main supply route, obstacles, mines, potential water points, and sources of engineer materials in their assigned area.

Minefields are reconnoitered to determine:

Boundaries.

Types of mines.

The presence of any gaps in the field and how they are marked.

Possible detours and approaches.

The location of defending weapons.

The location of chemical and radiological contaminated areas.

The engineer must prepare his recommendations to the tactical commander for employing his engineer resources to their best advantage in support of the commander's scheme of maneuvers.

Breaching Obstacles. All breaching equipment must be well forward in anticipation of encountering large tactical minefields, tank ditches, log and concrete obstacles. These obstacles can be expected in depth requiring an abundance of expendable breaching devices and demolitions.

CEVs and ALVBs will play a lead role in the attack and should be located forward where they can best support leading elements of the task force.

Requirements for M157 and M173 line charges, bangalore torpedoes, and conventional demolitions must be predetermined and requested early from normal supply channels. Likewise, supplies such as M180 cratering devices must be ordered to support countermobility plans.

When the area through which the division will attack contains an unfordable river, plans must include provisions to cross it without loss of momentum or significant concentration on either bank.

Other types of gaps such as antitank ditches, road craters, canals, narrow streams, and other similar obstacles must be spanned rapidly and economically. This can be accomplished with expedient methods employing AVLBs, demolitions, non-standard bridging materials, or earthfills emplaced by dozers or CEVs.

In planning for passage of a defile, alternate routes must be designated. Selected routes should take advantage of concealed approaches to and through the target zone.

Passage should not be planned to depend exclusively on the use of roads. Adequate deception measures must be planned to further the success of the defile passage operation. Engineer work required to prepare the defile site for passage should be accomplished under conditions of reduced visibility or at night when practicable.

During the attack, engineer work for the *assault of enemy strongpoints* will be

concentrated on breaching of the outer and larger obstacles which protect the main fortified position.

Specially organized and equipped assault forces are charged with the reduction of weapons emplacements, bunkers, and pillboxes, and the clearing of close-in and minor obstacles.

Close coordination is essential between those engineers breaching the line of obstacles and those tank/infantry assault forces reducing the fortifications.

After the fortified line has been breached, the primary engineer task is the creation and maintenance of routes to and through the gaps, with a secondary mission of destroying, by demolition, the captured fortifications or pillboxes.

The CEV demolition gun can be used to great advantage against fortified positions. Also, the CEV can be used to clear rubble and debris and close entrances of captured fortifications.

3 EXPLOITATION

When an attack succeeds, exploitation and pursuit should follow.

Exploitation. An exploitation is initiated when the enemy is having recognizable difficulty in maintaining its position. Indications of disintegrating enemy defenses include:

Sharp decrease in volume of enemy fires.

Sharp increase in capture of prisoners.

Capture of large quantities of abandoned enemy materiel.

Overrunning enemy artillery positions, command facilities, signal facilities, and supply dumps.

The division exploits by reinforcing success. The division commander shifts fires and maneuvers brigades to concentrate the combat power of the division at the place of greatest opportunity.

Brigades are required to clear only enough of their assigned zone to permit rapid advance and to avoid dilution of combat power. Enemy forces that cannot be easily bypassed or that block the advance are contained and suppressed, or destroyed by follow-on and support forces. Containment is conducted with minimum force. Follow-on and support forces relieve the containing force as soon as possible, allowing them to rejoin the exploiting force.

4 PURSUIT

Pursuit. A pursuit is the culmination of a successful attack and exploitation. Its purpose is to cut off and annihilate a retreating enemy. Pursuit begins when the enemy begins abandoning prepared defensive positions. The primary purpose of the pursuit is complete destruction of the enemy and their will to fight. It is *similar* to exploitation in that constant pressure is maintained on the withdrawing enemy.

It differs from exploitation in that:

Operations focus on destruction of the enemy.

Major combat forces are positioned behind withdrawing enemy elements to envelop or encircle and trap them.

The enemy is crushed between direct pressure and enveloping forces.

Engineers in Exploitation and Pursuit Operations. Engineers in exploitation and pursuit operations should be located well forward in the columns to aid the movement of the force. Engineers usually are attached to the pursuing force because of the distances involved. Engineer missions resemble those in the movement to contact and the attack.

As the exploitation develops, coordination between division and corps engineers is essential for relieving division engineers of tasks behind the attack area so they can continue to have their engineer system forward with the exploiting maneuver elements.

Once pursuit begins, the enemy normally will not have time to employ extensive

obstacles. However, the engineer must expect to encounter a number of enemy obstacles which require minimum time to employ but inflict maximum interference to movement by the pursuing forces. Such obstacles could include destroyed bridges, road craters, abatis, and interdiction mining. As in the attack, breaching equipment must be well forward in anticipation of encountering and breaching these obstacles.

LIMITED OBJECTIVE OPERATIONS

Reconnaissance in Force. A reconnaissance in force is a limited objective attack to obtain information and to discover and test enemy dispositions and strength. Although the primary purpose is to gain information, the reconnaissance in force is conducted to get a reaction from the enemy. His reactions may reveal major weaknesses in defensive systems. Such vulnerabilities, when promptly exploited, could lead to important tactical successes.

The reconnaissance force must be large enough and possess the combat power necessary to force the enemy to react strongly to the attack, disclosing locations, dispositions, strength, planned fires, and/or planned use of reserves. A division-directed reconnaissance in force may employ as much as a brigade, but normally will consist of a battalion task force.

Raids. Raids are small-scale attacks into hostile territory. They normally end with a planned withdrawal or extrication on completion of the mission. Raiding forces normally are assigned one or more of the following missions:

Capture prisoners, installations, or enemy materiel.

Destroy enemy materiel or installations.

Obtain specific information of a hostile unit, its dispositions, strengths, capabilities, or methods of defense.

Seize and hold terrain to fix enemy forces and facilitate future attacks.

Deceive or harass enemy forces.

Spoiling Attacks. Spoiling attacks are conducted to destroy a portion of the enemy force, throw the enemy off balance, cause the enemy to alter his plans, gain time for a larger force, or to deny enemy surveillance of the battle area. Although the spoiling attack is an offensive operation, it is normally employed while the division is defending. The spoiling attack is conducted similar to a hasty attack in a movement to contact. On contact, the attacking elements develop the situation, employ fire and maneuver, and close with the enemy to inflict maximum losses.

Engineers in Limited Objective Operations. Normally, in a reconnaissance in force, little engineer assistance is required. The engineer should, however, commit reconnaissance teams to gather engineer intelligence on the area of operation, particularly information on obstacles employed by the enemy. This information will be useful when future breaching operations are planned.

During the conduct of raids, the engineer plans to commit a small sapper force to use demolitions to breach obstacles, destroy materiel, or destroy small facilities.

DECEPTION OPERATIONS

Feints. Feints are diversionary supporting attacks. They are usually shallow, limited objective attacks varying in size from company team to brigade supporting attacks. They contribute to enemy defeat by drawing his attention away from the main attack.

Demonstrations. Demonstrations are staged to deceive in an area where a decision is not sought. Although the demonstration is

similar to a feint, no maneuver or contact with the enemy is intended.

The stationary nature of a demonstration permits maximum use of simulations, decoys and dummies, and inoperative equipment to deceive visual reconnaissance and surveillance by the enemy.

Ruses. Ruses are tricks to deceive the enemy. Generally they are single actions and may be planned or impromptu. They may be employed by tactical units to cause the enemy to disclose his intentions, state of morale, or combat readiness.

Engineers in Deception Operations.

Engineers are teamed with maneuver elements during deception operations and perform essentially the same engineer tasks as those performed in the main attack in order to add realism and plausibility to the operations. The thrust of their effort is directed at deceiving the enemy into believing what the division wants him to believe in order to gain an advantage over him during offensive operations.

Visual deception is a key element in deception operations, and it is an element of primary interest to engineers. Engineer tasks include:

Providing technical assistance on camouflage and concealment.

Providing technical assistance on installation of dummy positions/decoys.

Constructing and providing materiel for dummy positions/decoys.

Section IV ENGINEER SYSTEM IN THE OFFENSE

In order to concentrate, fight, and win, Army forces must *move* decisively on the battlefield. The *engineer system* provides the skills and equipment essential to the movement of friendly forces. The engineer system is employed in the offense *under the direction of the division engineer*.

The SYSTEM:

Enhances the division's mobility.
Counters the enemy's mobility.
Increases the division's survivability.
Provides general engineering to the tactical forces.

MOBILITY

Mobility focuses on reducing the effects of obstacles so that the maneuver ability of tactical units is improved and the mobility of critical supplies is increased. Priority of engineer effort in the offense goes to bypassing or eliminating obstacles located in the path of advancing units.

Mobility operations encompass:

Neutralizing and breaching obstacles.
Crossing natural gaps.
Assaulting strongpoints.
Maintaining combat roads and trails.

Neutralizing and Breaching Obstacles. Threat doctrine emphasizes employment of obstacles in depth during defensive operations. Obstacles which the Threat forces might employ against an armor/mechanized infantry force may consist of:

Minefields.
Log obstacles such as abatis, log cribs, stumps, and posts.
Tank ditches and craters.
Wire obstacles.

Methods of Breaching. In the interest of conserving time and manpower, *all obstacles will be bypassed if possible.* If this cannot be done, *two methods of breaching* may be employed:

1-Assault breaching. This is a tactical breach. It is used when the momentum of the attack must be kept up. It will usually be conducted under fire, therefore, speed is extremely important. Combat engineers should be located with the lead elements of maneuver units to perform assault breaches. However, time and distance factors may require assault breaches by maneuver units without direct engineer participation.

2-Deliberate breaching. This is done when speed and the protection of our own troops are not demanded. *Engineers do the job.* Rapid breaching methods that can be used, as in assault breaching methods, particularly for minefields, are hand detection and detonation.

Selecting a Breaching Method. The breaching method selected by the tactical commander depends on the following:

Mission. Is continuous enemy contact required? This factor alone often determines the breaching method.
Time and personnel available. How much time does the situation allow and are there sufficient numbers of trained personnel available?
Need for deception and surprise.
Weather and light conditions.
Mechanical and explosive breaching devices available. Are M1A1, M157, or M173 line charges, or tank-pushed mine rollers available to support an assault breach? Are electronic detectors available for a deliberate breach?

Smoke. Can smoke be used? Is it available?

Support. Are additional corps engineers (personnel and equipment) available?

Enemy defenses. Is the obstacle covered by observation and direct fire? What is known so far about the Threat's minefield employment?

Density and pattern.

Depth and employment of belts.

Types of mines, to include chemical mines.

Boobytraps.

Organizing Forces for a Breach.

Maneuver forces, assigned the mission of penetrating and destroying the enemy's defense and securing the terrain seized, may be organized into three elements:

1-The Assault Force. The mission of this unit is to make a penetration of the defense and to destroy the enemy in the area being attacked. An assault force is built around an infantry unit. Engineers are an integral part of the force.

2-The Breaching Force. The mission of the breaching force, if designated, is to create lanes in the enemy's obstacle system to allow passage of the assault force into and through the defense. The breaching force will widen the lanes later to allow continuation of the operation. These forces normally are composed of engineers, infantry and armor and are heavily supported by the support forces. After the breach is completed, they are reorganized to assist the assault force.

3-The Support Force. The support force includes all units providing close, continuous, overwatching fires to support the assault force. The support force normally consists of tanks, TOWs, *combat engineer vehicles*, and infantry other than the assault unit. Also, the

assault force normally forms its own support elements to provide close supporting fires for the assault force. As required, some of the support forces (TOWs, tanks, CEVs) may become a temporary part of the assault force's support element and have their fires directly controlled by the assault force to insure the necessary close coordination of fires.

Types of Breaching Equipment/Devices and Their Employment. The table on page 3-19 lists the types of breaching equipment and devices found in division and corps engineer units and ammunition supply points (ASP). (The tank-pushed mine roller, organic only to the armor companies of division Europe, is listed also.) The table also shows how the equipment and devices may be typically employed against obstacles.

Neutralizing and Breaching Minefields.

General. Minefields will differ in layout and composition, depending on availability of mines and nature of avenues of approach. Whenever possible, mines are detonated in place.

Manual methods must be used when mechanical or explosive breaching devices are not feasible. These include mine detection followed by destruction or removal of located mines. The rate of breaching by these methods is *slow*, not over 0.5 km per hour under ideal conditions.

The initial objective of the *assault breach* is to make a safe route to the far side. This is done by breaching foot and vehicle lanes through the field. The number and type of lanes breached depend on:

The size of the breaching force.

The depth and density of the field.

The equipment available.

Foot lanes. If a *mounted assault* breach is not feasible, then at least one foot lane is needed for each assault company. This lane normally is two meters wide and marked with white marking tape along its centerline.

**BREACHING EQUIPMENT/DEVICES
WHERE IT IS FOUND AND
HOW IT IS USED**

The table below lists breaching equipment/devices found in division and corps engineer units and ammunition supply points (ASPs), and indicates its use against obstacles.

EQUIPMENT AND DEVICES	LOCATION			USE				
	DIVISION	CORPS	ASPs	MINE FIELDS	TIMBER OBSTACLES	CONCRETE OBSTACLES	EARTH OBSTACLES	WIRE OBSTACLES
Combat Engineer Vehicle	•			•	•	•	•	•
Dozer	•	•		• B	•	•	•	•
Scoop Loader	•	•			•		•	
Backhoe	•	•					•	
AVLB	•						•	
Mine Roller A	•			•				
Mine Detectors	•	•		•				
Demolition Set	•	•		•	•	•	•	•
Chain Saw	•	•			•			
Pioneer Tool Kit	•	•			•		•	
M1A1 Bangalore			•	•				•
M157/M173 Line Charges			•	•				
M1E1 line Charge			•	• B				
Demolitions (C4, TNT, etc.)	•	•	•	•	•	•	•	•

A Found in armor companies of divisions in Europe only. Authorized one roller per company.

B Antipersonnel mines only.

Full use is made of darkness, smoke cover, breaching devices (mechanical or explosive), and covering fires.

Initial patrol lanes may be breached in defiles that give cover and concealment to assault troops even though these lanes may not be widened into vehicle lanes later.

The Bangalore Torpedo. The bangalore torpedo will clear foot lanes through mines and wire obstacles. It clears a path 3 to 4 meters wide through wire entanglements. It will clear a narrow foot path through a minefield by exploding most of the antipersonnel and single pulse-fuzed antitank mines of the minefield.

Once there are foot lanes through the minefield, assault forces move through rapidly to neutralize any nearby enemy positions and secure the far side of the obstacle.

Vehicle Lanes. After the first breach is made, foot lanes may be widened to one-way vehicle lanes at least 8 meters wide. Vehicle lanes also may be breached separately from foot lanes. Existing roads are used when possible, clearing mines along their entire width.

Tank-pushed rollers and M157 and M173 line charges are used to clear vehicle lanes. (The mine roller is organic to the armored battalion.)

M157 Line Charge. The kit weighs 11,000 pounds including approximately 3,200 pounds of explosive. In most soils this charge forms a crater about 90 meters long, 4 to 5 meters wide, and 1 to 1-1/2 meters deep. It can be assembled in about 8 man-hours with a crew of four to eight men. See TM 9-1375-204-10 for details.

M173 Rocket-projected Line Charge.

This is an AT minefield clearing device which is towed (dragged) by a vehicle or helicopter to the edge of a minefield. It is used to clear a path through single impulse pressure-type mines. When projected across the field, the rocket tows a flexible line charge to a coverage of about 70 meters. When this line charge explodes, it clears a vehicle lane about 6 meters wide. See TM8-1375-202-10 for details.

The breaching force notifies the main maneuver force by wire (laid behind the breaching force), messenger, or some other prearranged signal when a lane sufficient for vehicles is clear. Additional smoke is placed on the far side and the maneuver force crosses the obstacle as rapidly as possible with tanks leading.

For more information on -

Mine/countermine operations at the company level, see: FM 20-32.
--

US mines, see: TM 9-1345-200, TM 9-1375-213-12.

Foreign mines, see: TM 5-280.

When a unit is attacking across open terrain, the minimum distance between lanes should be from 250 to 300 meters. This keeps the enemy from blocking more than one lane with a single artillery concentration. The distance between lanes may be greater than 300 meters, the distance being dependent on the commander's ability to maintain control of his force.

After the initial assault, lanes are widened to at least 16 meters for two-way traffic. As lanes are widened, marking tape is used to mark both sides of the lane for safety of two-way traffic.

To provide a means of rapidly marking minefields, the XM133 Hand Emplaced Minefield Marking System (HEMMS) is being developed. This system will consist of lightweight metal poles, a light emitting diode flasher, and a highly visible tape to connect the poles.

Once the attacking unit has moved through the minefield, additional clearing of lanes and their marking will be the responsibility of follow-on engineer units.

Neutralizing and Breaching Log Obstacles.

General. Abatis are effective obstacles to vehicular movement where roads, trails, or firebreaks pass through heavily wooded areas. They may be mined and covered by fire.

Wooded areas with trees or stumps and vertical posts can be effective obstacles to vehicular movement.

Cribs and hurdles, reinforced by boobytraps and other antihandling devices, are used across roads and trails.

Destruction. The quickest way to reduce log obstacles is to use demolitions. The CEV demolition gun is very effective against many obstacles such as roadblocks, log cribs, and trees. It has a maximum effective range of 900 meters.

Small demolition teams of engineers and infantry may be required to reduce some of the obstacles by placing charges generally at points where the obstacle is weakest. Charges placed on obstacles driven into the ground should be attached below or as close to the surface of the ground as possible.

If demolitions are not available, use saws and axes. Use vehicles to pull or push logs out of the lanes.

Neutralizing and Breaching Tank Ditches and Craters.

General. In open country, antitank ditches are constructed to strengthen prepared defensive positions. Craters are used for blocking roads, trails, or defiles at points where the terrain prevents bypassing. Antitank and antipersonnel mines are often placed at the site to hamper breaching operations.

Destruction. Once the mines have been neutralized, the CEV can be used to push down the sides of ditches or to fill in craters. Also, explosives can be used to cave in the sides of ditches sufficiently to allow passage of traffic. If the gap is less than 57 feet, AVLBs can be used to span the gap. (See page 3-22 for details on employment of the AVLB.)

Neutralizing and Breaching Wire Obstacles.

General. Wire by itself is not a significant obstacle to mechanized or armor forces. When used as a roadblock, wire will stop wheeled vehicles when it is properly sited to achieve surprise and to preclude bypass. Wire can be a nuisance by damaging suspension systems or halting vehicles long enough for soldiers to cut it away.

Destruction. The CEV demolition gun, tank and artillery fire, bangalore torpedoes, and explosives may be used to clear passages through wire.

Crossing Natural Gaps. Natural gaps found in the combat zone include relatively short gaps such as narrow streams, canals, washouts, and ravines, and larger natural obstacles such as rivers and lakes. As is true with other obstacles, natural gaps will be bypassed, if possible, in the interest of conserving time and manpower. However, if gaps have to be crossed, speed and aggressiveness are essential to the success of the crossing operation.

Methods of Crossing. Two methods of crossing may be employed.

1-Hasty crossing. A hasty crossing is used when the momentum of the attack must be kept up. This is the preferred method of crossing against weak enemy defenses.

2-Deliberate crossing. A deliberate crossing is made when a hasty crossing has failed or is infeasible. This method requires detailed planning and a buildup of firepower and crossing equipment.

Further details on methods of crossing are contained in appendix F, River Crossing Operations.

Crossing Short Gaps.

General. Short gaps can be crossed by any fixed bridging available in the main battle area. Normally, AVLBs are used to cross short gaps that are not more than 57 feet (17.4m) wide. They can carry any class 60 load in the division. The medium girder bridge (MGB) is a tactical bridge which can span a gap up to 95 feet (29m) and can also carry a class 60 load. Wet gaps are rapidly spanned with the mobile assault bridge (MAB) and the ribbon bridge.

Employment of the AVLB. The bridge company of the division engineer battalion has one AVLB platoon with two AVLB sections. The AVLB platoon has six bridges and four bridge launchers. The bridge launchers transport four of the bridges;

tractor-trailors carry the remaining two bridges. In addition, an AVLB section is organic to each tank battalion. Each section has two bridges and two bridge launchers.

Normally, the engineer AVLB platoon or one of its sections is attached to a forward engineer company for employment primarily in assault crossings of short gaps by combined arms teams. The AVLB is particularly suitable for spanning narrow streams, antitank ditches, craters, canals, partially blown bridges, and similar obstacles which normally would slow the momentum of attack. It can be launched or recovered in about five minutes. It may be placed over existing bridges or portions of existing bridges to increase the load-carrying capacity of these bridges.

When a gap is encountered by the leading elements of the task force, the proposed crossing site is reconnoitered quickly by the scout elements, by the engineers, or both. They:

Determine the width of the gap.

Determine the bank conditions.

Locate access routes.

Mark and determine the launching site.

On approval for emplacement by the crossing force commander (brigade commander), an AVLB is brought forward under the overwatching fire of the leading tactical elements and emplaced quickly. The successful emplacement of an assault bridge is reported immediately by the tactical commander, to brigade. This report should include:

Bridge location.

Estimated time task force elements will complete crossing.

Mechanical condition of bridge.

The AVLB should be left in place across the gap only so long as it is needed. When the last tactical element of the task force has crossed, and in the absence of orders from the brigade

commander to *leave the AVLB in place*, the task force commander will direct recovery of the emplaced bridge. On recovery of the assault bridge, the launcher should be given route priority in order to move it forward into position with the leading tactical elements. The *recovery of the bridge must be reported to the next higher headquarters.*

The AVLB may be left in place to permit the crossing of units following the assault elements, or to provide routes for subsequent logistical or other tactical movement. When the brigade commander directs that an AVLB remain in place, he takes the following actions:

Reports the decision immediately to division G3.

Requests a replacement bridge.

Establishes a rendezvous for transshipment of the replacement bridge to the organic launcher.

When a replacement bridge is provided by an engineer unit a spare bridge from the engineer AVLB platoon is brought forward and placed on the launcher. The launcher then moves to rejoin the leading tactical elements.

If the division engineer battalion has expended its supply of bridges, or if priorities prevent the transfer of a spare assault bridge, the replacement bridge will come through normal logistic channels. Resupply of AVLBs to both the engineer and tank battalions is the responsibility of DISCOM.

Recovery of emplaced AVLBs for reconstitution of the engineer battalion capability or for return to supply channels will be accomplished by the division engineer bridge company.

Employment of the MGB and Other Fixed Bridging. The engineer medium girder bridge company is a corps unit. It has two bridge platoons and four MGB sets. Under normal conditions, one 100-foot (30.5m) class 60 bridge can be constructed in approximately one and a half hours.

Normally, the MGB would be used to replace AVLBs that are needed forward in the advance. It also could be emplaced as an assault bridge to span gaps exceeding the AVLB's capability.

Other fixed bridging may be constructed to cross gaps of various widths by using components of the light tactical raft set, the M4T6 bridge, or the class 60 bridge. TM 5-210 gives complete details on the types and classes.

Expedient Methods. Gaps can be bypassed or spanned rapidly and economically with expedient methods employing demolitions to reduce the banks, nonstandard bridging materials, or earthfills emplaced by dozers or CEVs.

Crossing Rivers.

General. The purpose of a river crossing operation is to move the attacking force across the river obstacle as rapidly and efficiently as possible. This permits the force to secure assigned objectives that will protect the crossing of the remainder of the force. A river crossing operation includes:

Advance to the river.
Final preparation for crossing.
The assault.
Advance on the exit side of the river.
Securing of the bridgehead.

When the area through which the division will attack contains an unfordable river, plans must include provisions to cross without loss of momentum or significant concentration on either bank. The river is approached at maximum speed on a broad front. All existing bridges in the zone of advance are objectives and every attempt should be made to secure these intact. However, success of the division plan for crossing the river is not predicated on the securing of bridges intact. If bridges cannot be secured intact, a hasty crossing is made on a wide front using multiple crossing sites and capitalizing on organic assault bridging amphibian characteristics of armored carriers, organic airlift capability, and

improvised means. When a hasty crossing is not possible, a deliberate crossing is conducted.

Employment of Engineers in River Crossing Operations. A river crossing is the tactical commander's responsibility, but the division engineer plans continuously for the support of division river crossings in the offensive. For major crossings, the division must be supported by corps units, and the division engineer makes the requirements for support known as early as possible to the corps engineer. In establishing those requirements, the division engineer maintains close liaison with G3 on plans, exploits all sources of intelligence to determine what may be needed, and performs constant reconnaissance to specifically determine the requirements.

Engineer tasks in the crossing include:

Guiding the assault forces from the assembly area (attack positions) to the crossing site.
Operating assault boats (when assault boats are required).
Assembling and operating rafts.
Assembling and maintaining heavy vehicular bridges.
Removing mines or other riverline obstacles.
Constructing approach roads and exits.

Appendix F suggests allocation of river crossing tasks between division and corps engineers.

All available crossing means are used to cross the maximum number of troops and equipment in the shortest time. Leading elements of the assault force cross the obstacle in amphibious vehicles. When sufficient quantities of amphibious vehicles are not available or the water obstacle banks prevent their use, assault boats are used. The division engineers have the primary mission of supporting the assault units during the assault phase by breaching obstacles, operating boats, preparing entrances and exits for vehicles, and aiding fording and swimming vehicles.

It is expected that the division engineer units will cross the water in their normal supporting configuration, prepared to undertake engineer tasks on the exit bank in support of the attacking unit. This leaves entry bank tasks and operation of the crossing sites primarily to corps engineer units.

Rafts are constructed as rapidly as possible for crossing the remainder of the assault echelon by both division engineers and attached or supporting corps engineers.

Bridges are rarely employed in the assault phase because of their vulnerability to enemy fires and the resulting requirement to concentrate assaulting forces at the crossing site(s). Bridges are emplaced to transport follow-on forces once assault elements have secured terrain that prevents enemy observation and adjustments of indirect fires.

Attached or supporting corps engineers usually are responsible for constructing bridges. When necessary, the division engineer battalion constructs mobile assault or float bridges, and expedient bridges.

Mobile assault rafts and bridges will be replaced by other floating or fixed bridging as soon as possible to permit the division bridge company to retrieve the MAB and continue to support the division. If the division bridge company is equipped with the M4T6 or class 60 floating bridge, the bridging normally is left in place, and it immediately obtains replacement bridging from the nearest supply source.

For a detailed discussion of river crossing operations see appendix F.

Assaulting Strongpoints. A strongpoint is a well-prepared fortified position designed to defend against an attack of armored vehicles and infantry.

Whenever possible, strongpoints are contained by minimum forces while the main force bypasses them and continues the advance to secure more distant and decisive objectives.

If the strongpoint is assaulted, the area selected for penetration must be isolated from the remainder of the mutually supporting defensive system.

The assault elements are tailored to their specific missions and should be specially trained and rehearsed, when time permits. Assault units normally are organized into task groups for specific functions. Groups may be formed for the following tasks:

Clearing antipersonnel mines in front of breaching personnel.

Breaching or otherwise neutralizing an obstacle.

Marking lanes and gaps after the breakthrough.

Providing local security.

Laying smokescreens to conceal operations of the group.

Standing by as a contingent to replace or reinforce.

Principal weapons used by the assault units are demolitions and direct fire weapons such as the TOW, Dragon, LAW, M202 rocket launcher, and the CEV demolition gun. Unless required for use by the attacker, captured enemy armament and fortifications are moved or destroyed to prevent their use if recaptured.

The defeat of an enemy defense is a four-step process:

1-FIND

Find the enemy while exposing yourself as little as possible.

2-FIX

Isolate the enemy.

3-FIGHT

Destroy the strongpoint.

4-FINISH

Exploit your advantage.

Organization of Enemy Strongpoints.

When required to assume a defensive posture, Threat doctrine requires units to immediately start constructing fighting positions. These positions will be improved until a strongpoint exists.

At the company level, enemy strongpoints are based on a three-platoon arrangement. Generally, the Threat doctrine of multiple defense belts dictates two platoons up and one back. It cannot be overemphasized, however, that although the 2-1 arrangement is more common, it is not the sole or necessarily the predominant one encountered.

Platoon positions are linked with each other through a series of trenches, and these trenches, together with obstacles and minefields covered by fire, are the basis of company strongpoints. The platoon is the lowest echelon which plans for the construction of obstacles.

It is the responsibility of the platoon leader to implement the immediate defensive obstacle plan. The obstacle plan, which incorporates AT and AP mines, barbed and coiled wire, and possible antitank ditches, normally is constructed immediately in front of the platoon strongpoint position. The

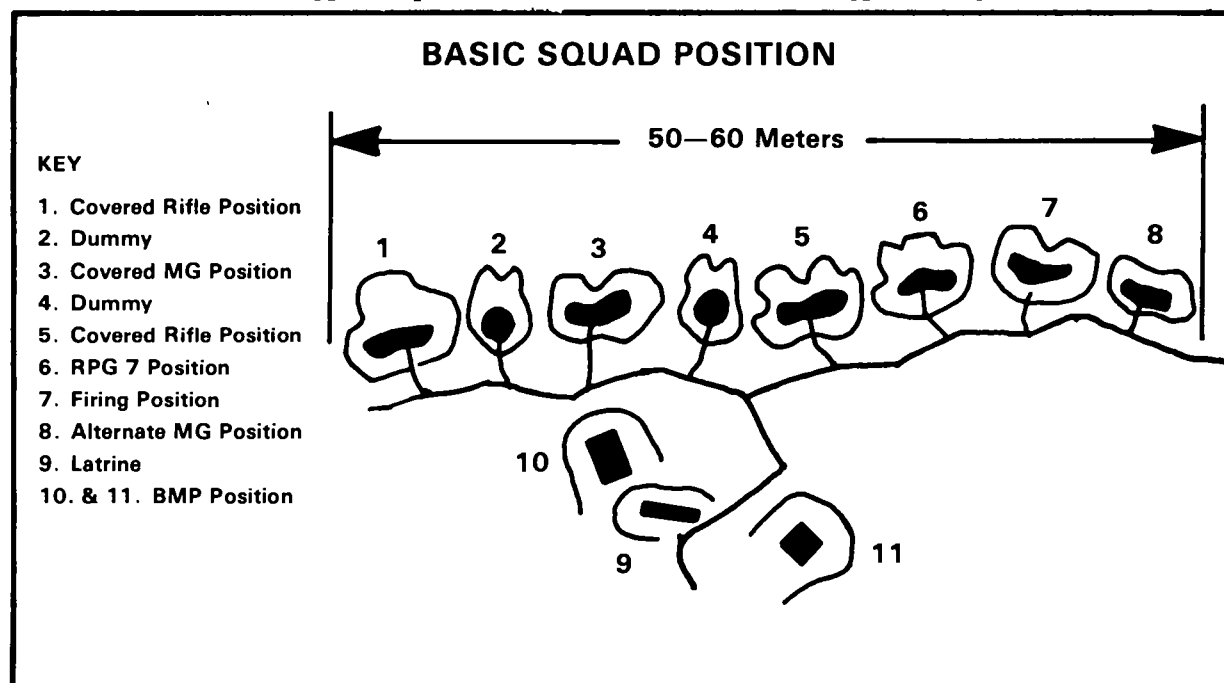
obstacles are using the strongpoint and bog down the enemy assault, fixing the assaulting vehicles and/or troops in the points of concentration.

The *squad positions* within the fortified platoon positions are a series of personnel and crew-served weapon fighting positions linked together by a trench. The three basic types of fighting positions are the single man, the 2- or 3-man, and the crew-served weapon positions.

The individual fighting positions are linked together by trenches to allow covered and concealed movement among the positions and between the first and second echelons of defense.

The trenches are dug manually, in which case they link positions directly; or by an entrenching machine which constructs a trench 2 meters behind the positions to which feeder trenches from the positions are connected. The trenches zigzag, with the length of each leg being 3 to 5 meters and the angles between legs being 120° to 150°. The trenches are not covered, but are revetted with available materials.

A typical enemy squad position in a company strongpoint might look like this:



Employment of Engineers. Employment of engineers in an assault of a strongpoint is fundamentally an application off the same techniques used for breaching any other obstacle of magnitude. Engineers are used in conjunction with a reinforced infantry platoon as the basic assault unit.

Detailed intelligence is required upon which to base training, rehearsals, and plans. Before the attack begins, a *preliminary engineer study* is made of the following:

Terrain.
Bridges.
Routes of communication.
Reinforcing obstacles such as minefields, tank traps, and emplacements.

The techniques of attack and the requirements for engineer breaching personnel, supplies, and subsequent reconstruction are based on this study.

Information for the study may come from various sources, of which ground reconnaissance is the most satisfactory. For areas beyond the reach of ground reconnaissance parties, information must come from aerial photographs and other sources.

Ground reconnaissance before the attack should, if possible, cover obstacles in front of, and on the flanks of, the enemy position. Minefields are reconnoitered to determine:

Their boundaries.
Types of mines.
The presence of gaps in the field and how they are marked.
Possible detours and approaches.
The location of defending weapons and chemical and radiological contaminated areas.

The reconnaissance parties seek to determine the positions of the obstacles which are best adapted for clearing operations, either because of their weakness or because they are not well covered by fire. Normally, reconnaissance is done by the troops who are to breach the obstacles. Parties are given definite routes and areas, carefully instructed in their duties, and when possible, rehearsed. They must operate in a manner that will not compromise planned operations. Personnel are briefed on all available information.

The area selected for penetration must be isolated. Smoke isolates individual strongpoints from the observed fires of other fortifications. Indirect fire weapons destroy camouflage, neutralize and destroy enemy field fortifications and artillery, fire on enemy counterattacks, and screen the movement of assault troops.

During the attack, the principal mission of the engineers is the breaching of the outer and larger obstacles which protect the main fortified position. Specially organized and equipped infantry squads are charged with the neutralization of weapons, emplacements, bunkers, and pillboxes, and the clearing of close-in and minor obstacles. Close coordination is essential between those engineers breaching the line of obstacles and those infantry squads neutralizing the fortifications.

As the assaulting troops break through or envelop the enemy position, engineers overcome the remaining enemy obstacles. Immediate exploitation of success is imperative. If the position is organized in depth, the attack or a new attack, constituted by another combined arms team must proceed to the second line of fortifications as soon as possible. The same techniques are used in reducing a second line as in the case of the first line.

After the fortified line has been breached, the primary engineer task is the creation and maintenance of routes to and through the gaps, with a secondary mission of destroying, by demolition, the captured fortifications or pillboxes.

When reducing field fortifications by the use of explosives, the techniques employed are essentially the same as those employed in the reduction of concrete walls. CEVs are used to great advantage against fortified positions.

Bulldozers are effective in the surmounting or bridging of obstacles, and for constructing and maintaining routes into and through the gaps. Other engineer equipment can be used to clear rubble and debris resulting from the demolition of fortifications. If all captured fortifications must be made useless, bulldozers and CEVs can move earth into the entrances of the captured fortifications instead of demolishing them.

Engineer operations in urbanized terrain (MOUT) are discussed in appendix E.

Maintaining Combat Roads and Trails. Priority of engineer route development and maintenance effort goes toward enhancing the forward mobility of the maneuver elements. Both division and corps engineers share in this task.

Division Engineers. In forward areas, each brigade engineer is responsible for accomplishing the minimum essential pioneer construction tasks which keep the brigade maneuver elements moving toward their objectives. Speed is essential. Therefore, division engineers concentrate their efforts on making quick fixes to repair bomb damages and to remove obstructions that hamper the movement of the advancing units. Division engineer resources devoted to the development and upgrading of essential supply routes and lateral movement routes in the brigade area will be allocated as time and resources become available.

The combat engineer company supplements its organic construction equipment capability with dump trucks, dozers, and graders from the equipment platoon of the engineer battalion's headquarters company as required. Tasks which exceed the brigade engineer's capability are submitted to the division engineer for accomplishment by other engineer units.

Corps Engineers. Corps engineers in support of the division may be employed within the brigade area on either an area or task basis. Tasks normally accomplished by them include maintenance of routes of communication and repair and replacement of tactical bridging. Maintenance of main supply routes will be accomplished by corps combat and combat (heavy) engineer units.

COUNTERMOBILITY

Counter mobility is *obstacle construction*. Although obstacles are used mostly in defense, they can be used also in the offense to:

Block or Inhibit Enemy Movement. Obstacles emplaced by friendly forces in the enemy's defensive area deny the enemy the ability to concentrate, withdraw, or reinforce. They allow friendly forces to isolate enemy strongpoints and defeat the enemy's defensive system of mutual support. Obstacles help secure the flanks of attacking forces during the initial phases of an attack. They assist in impeding enemy counterattacks during the reorganization phase following the securing of an objective.

Concentrate Combat Power. Obstacles let friendly forces hold an area with fewer men and weapons on line. They *reinforce the existing obstacles* and strengthen the defenses of the remaining units defending the thinned-out zone. Obstacles free vital soldiers and weapons for attacking the enemy.

Counter mobility operations encompass the employment of:

Reinforcing obstacles.

Existing obstacles.

Atomic demolition munitions (ADM).

Employment of Reinforcing Obstacles. There are some constraints to the use of obstacles in the offense:

Ability to effectively emplace obstacles in enemy held territory.
--

Impact obstacles will have on the movement of friendly forces.

The commander will seldom have sufficient time and resources (soldiers, materials, equipment) to develop the total obstacle potential of the available terrain. Therefore, the commander and his engineer must be able to rapidly evaluate the terrain and develop one best system of reinforcing possible obstacles in the time available.

The key to the effective use of obstacles in the offense is timing and placement. It is essential that obstacles emplaced by friendly forces are not used against them. Therefore, close control of employment normally is retained at division and brigade level to minimize impact on future operations and friendly mobility. Authority to employ selective obstacles (i.e., artillery-delivered mines with a "short" self-destruct time) may be delegated to the task force commander; however, this will be strictly controlled. Control measures will consist of geographical limitations and time restrictions.

To be effective, obstacles should be:

Covered by fire or kept under surveillance.

Sited to take full advantage of existing and other reinforcing obstacles.

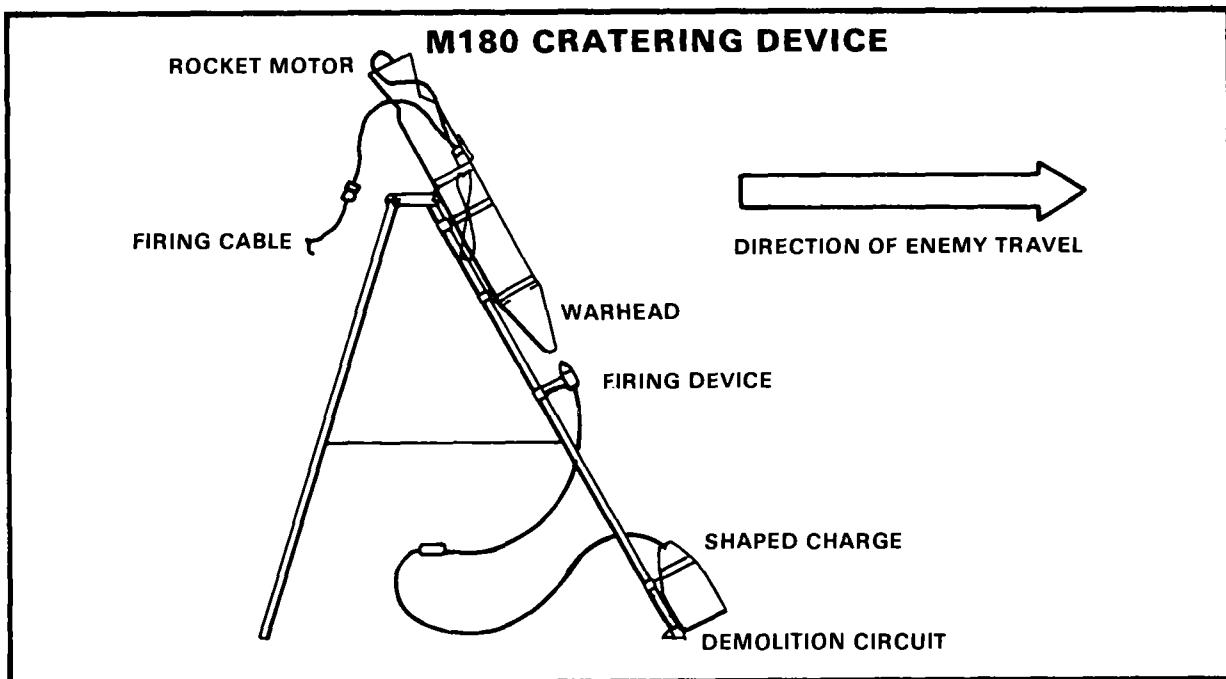
The speed of the attack and the time required for emplacement normally limit reinforcing obstacles to *hasty road craters* and *minefields*.

Hasty Road Craters. Craters may be used effectively by maneuver forces in the offense. Craters can be created in 0.5 squad hours when using the M180 cratering device.

To be effective obstacles, craters must be too wide for spanning by tracked vehicles and too deep and steep-sided for any vehicle to pass through them. They are considered effective antitank obstacles if the tank requires three or more passes to traverse the crater, thereby providing sufficient time for antitank weapons to stop the tank.

They should be used on roads or trails when the area on the flank of the crater is tied into another obstacle or is mined and/or covered by antitank fire. As many as two or three craters should be used at one location.

Minefields. The engineer is the primary staff planner for the employment of mines; however, the mines are emplaced by a variety of means allocated to both nonengineer units (i.e., aviation, artillery) and engineer units. Close coordination with supporting units is required.



Some typical tactical employment situations for mines are:

Placing Mines Behind an Enemy Unit. During the attack, artillery fire missions will be called to deliver scatterable mines to seal enemy withdrawal routes or counterattack routes. These fire missions will be called and controlled in the same manner as standard fire missions. This provides the opportunity to hold the enemy in an area which is to our advantage. Using the "short" self-destruct time, the blocking minefield will destruct, permitting the attack to continue. This use of mines requires extremely close control to insure they do not restrict the friendly attacking forces. The minefield location and time the mines will self-destruct will be transmitted to all tactical headquarters in the immediate area.

Rapid Flank Mining. During the attack, the tactical commander can use mines as an economy-of-force measure for flank security. The M56 helicopter-delivered mine system (found only in Europe) employs antitank mines with a "long" self-destruct time. The most significant constraint on employment of the M56 is the vulnerability of the helicopter. Against any enemy with a significant air defense capability, employment normally will be limited to secure areas or require suppression of the enemy's air defense in the area to be mined.

The M57 antitank mine dispenser (found only in Europe) replaces the M15 antitank mine at an optimum rate of 380 mines per hour. Basis of allocation for the M57 dispenser is one per combat engineer company. It is maintained at army depot until its use is required.

An important point to *remember* is that *mines delivered into enemy territory will not be marked*. However, for control purposes, these locations will be maintained on operations maps at battalion and higher headquarters. The tactical commanders must know also the time that scatterable mines are to self-destruct, thus permitting passage through the area.

The introduction of the Family of Scatterable Mines (FASCAM) on the modern

battlefield in the 1980s will enable even more effective obstacles to be employed with a minimum loss in time and manpower. For a detailed discussion on evolving concepts in mine doctrine, see appendix L.

Employment of Existing Obstacles. Mountains, forests, escarpments, rivers, lakes, and swamps are just a few of the many natural obstacles to movement that can be used as a countermobility measure by attacking forces. Details on existing obstacles (both natural and cultural) and what determines their obstacle value in thwarting a potential counterattack from enemy forces are covered in chapter 4, Defense. The ability to recognize and evaluate the obstacle potential of portions of the terrain and to employ the existing obstacles to the attacker's advantage is critical to the success of countermobility operations in the offense.

Employment of Atomic Demolition Munitions (ADM). When it is decided to employ atomic demolition munitions, the execution mission normally is assigned to the division responsible for the area in which the demolition sites are located. ADM missions in the division area may be accomplished by teams from the corps' ADM company; however, if the number of targets warrant it, the engineer recommends attachment of additional TOE 5-570 cellular-type ADM teams to the division. All matters concerning ADM are coordinated through the corps engineer.

SURVIVABILITY

Survivability during the offense is characterized by the employment of *protective measures* which will decrease the lethality of the enemy's firepower while units maneuver toward him.

Protective measures include the use of:

Countersurveillance measures.

- Camouflage
- Deception
- Smoke

Protective positions.

Countersurveillance Measures. Over the past 20 years, the surveillance threat has grown enormously, and there are now many surveillance sensors that might be employed against friendly forces. It is virtually impossible to defeat all the surveillance activities of the enemy when a force is on the offense. However, the way to reduce the effectiveness of these sensors is to exploit their limitations and the limitations of the personnel who operate them.

There are six rules to follow when considering countersurveillance.

1-Identify the threat.

2-Avoid detection by the enemy's routine surveillance.

3-Blend with the environment.

4-Minimize movement.

5-Use deception correctly.

6-Treat night as day.

Camouflage. Camouflage is the process of making a person or object blend with the background so as to become more difficult to distinguish from the background. Although camouflage is each unit's responsibility, engineers are looked to as the experts and are expected to provide technical advice and assistance. In a fast moving offensive situation, it is doubtful if time will allow extensive *artificial camouflage measures*. However, engineers advise and assist other troops in the use of *natural* features which will aid in camouflage and concealment.

Deception. Deception can be used effectively to help gain surprise for the attacking force. Deception can take the form of having units simulate defensive preparations or reveal false attack preparations in some place other than the planned point of attack.

The main interest of engineers is in visual deception. During preparation for offensive operations, special attention is given to camouflage, concealment, and disguise of units and activities which may reveal friendly plans. Division engineers, in coordination with signal and intelligence

elements, may install and move decoys, fabricate disguises, and construct covered routes and positions as required to counter enemy intelligence systems in consonance with command plans for counterintelligence and deception.

Smoke. Smoke generally is not equated to combat power because it is not lethal. Nevertheless, when used correctly, it can significantly reduce the enemy's effectiveness in both the daytime and at night. Combined with suppressive fire, smoke will provide increased opportunities for maneuver forces to deploy while minimizing losses.

Smoke attenuates laser beams and inhibits the use of optically guided missiles such as the Sagger. Smoke may be used not only to reduce the ability of the enemy to deliver effective fires but also to hamper enemy operations and deny information on friendly positions and maneuvers.

The effective delivery of smoke at the critical time and place on the battlefield will contribute significantly to the combined arms team winning the first battle.

Dispensing systems include:

Munitions: grenades, grenade launching systems, mortar and artillery rounds, and smoke pots. As applicable, all units should carry these items in their basic load.

Specialized systems: ground or vehicle-mounted smoke generators located in company-size chemical units, the M52 subsystem which mounts on UH1 helicopters, and an engine exhaust system that will be used with the diesel engine armored vehicle.

The engineer must be prepared to plan for the use of smoke when it is applicable to his various task assignments.

Smoke placed within friendly areas will draw fire; therefore, screens must be large enough so that random enemy fire will not cause excessive casualties. Deceptive screens

HOW SMOKE IS USED

The proper use of smoke can assist the ENGINEER to accomplish his combined arms team mission. The following chart displays normal use of smoke.

ACTION	TYPE OF SCREEN	USE	SIZE	TIME OF DELIVERY
River Crossing Operations	Obscuring smoke on enemy positions. Smoke ALTN crossing sites as a deceptive measure.	Reduce direct observation.	Depends upon enemy positions.	H-1 hour and continuing.
Assault Phase	Haze on friendly positions.	Deny clear visibility of large objects from distances greater than 100 m during all phases.	Size of crossing area X 1.25.	H - 20 min.
Rafting Phase	Haze on friendly positions.		Size of crossing area X 1.25.	Prior to initiation of waterline operations and continuing during rafting operations.
Bridging Phase	Haze on friendly positions.		Size of crossing area X 1.25.	Prior to initiation of waterline operations and continuing during bridging operations.
Breaching Operations	Obscuring smoke on enemy positions. Smoke ALTN crossing sites as a deceptive measure.	Reduce direct observation.	Dependent upon size of enemy positions.	As soon as maneuver commander discovers the obstacles.
Assault Breaches	Haze on friendly troops.	Deny clear visibility of large objects from distances greater than 100 m.	Obstacle width X 1.25.	Deliver as breaching action begins.
Deliberate Breaches	Haze on friendly troops.	Deny ground-to-ground observation.	Size of obstacle X 1.25.	30 minutes prior to start of breach.

should be placed in unoccupied areas to cause the enemy to disperse his fires and expend his ammunition. Smoke should be placed directly onto known or suspected enemy held terrain at the same time it is placed within friendly areas. This combined use of smoke will require extensive coordination, but the end result will contribute significantly to every friendly operation.

Some typical uses of smoke in support of engineer tasks in the offensive are given in the table above.

Protective Positions. Protective positions include both natural and improved terrain features as well as manmade structures that can be used to improve the survivability and effectiveness of the

advancing units.

During offensive operations, the maneuver forces rely upon the division engineer, together with the division terrain support element, to provide reliable terrain intelligence. This intelligence will enable the maneuver force commander to decide what routes of advance offer the greatest protection from enemy fire and observation. Areas that can mask the movement of friendly forces or passively suppress enemy fire provide a considerable degree of protection on the battlefield.

During temporary halts to consolidate and regroup, engineers develop and improve as many protective positions as possible. Antitank weapons, indirect fire weapons,

and critical supplies such as ammunition and POL usually require protective positions. These positions are usually expedient in construction and are sited to make use of natural terrain to provide maximum protection. Only side and frontal protection from enemy weapons is provided by these protective positions. Time usually limits improvements to such positions to single slot cuts and earth berms using the CEV or dozer blade.

GENERAL ENGINEERING

General engineering is the support of units and activities in the brigade and division rear areas. The division engineer battalion is staffed and equipped to work for the committed maneuver brigades. Corps engineers, who are supporting the division, provide the primary capability to accomplish general engineering tasks in the division area.

During offensive operations, general engineering tasks include:

Improving and maintaining essential combat and main supply routes.
Replacing assault or blown bridges with tactical bridging.
Clearing minefields.
Developing forward support areas for rearming and refueling.
Providing potable water.
Providing terrain studies.

Improving and Maintaining Essential Combat and Main Supply Routes. In the division area, engineer tasks directed at improving and maintaining essential combat and main supply routes will be accomplished by the engineer units that are not in direct support of brigades. Control by the division engineer or organic units or units under his operational control can be by specific task assignment or area assignment. Both combat and combat (heavy) engineer battalions from corps have a horizontal construction capability. Normally, the corps combat battalions will concentrate their

effort on hasty repair of existing roads; whereas, the combat (heavy) battalion, with its greater earthmoving capability, can be employed on projects that require more extensive construction and repair.

Divisions ordinarily require at least one road as a main supply route and access roads to the combat and combat service support elements. Operations in the combat zone seldom permit extensive road building to be undertaken. Thus, the operational road net will usually consist of routes selected from the existing road system. New construction ordinarily is limited to construction of bypasses around obstacles and short pioneer roads for access to tactical positions and assembly areas.

The existing road network is rarely adequate for the intense traffic and heavy loads of a division and, therefore, must be widened, improved, and constantly maintained.

Route improvements and repairs are accomplished rapidly, making the best use of local resources. The route must be able to withstand hard usage, and plans must allow for expansion and improvement of the route as well as accommodation of immediate needs. Roadwork is progressive in character. Hasty repair of existing roads and installation of temporary bridges necessary for the passage of combat elements are followed by more deliberate improvements and construction.

Routes must accommodate military traffic without delay. Work on the route network, however, is not complete with initial repairs or improvements. When portions of the network are damaged, repairs are prompt. The engineer is informed continuously about the condition of the route network so that the assignment of equipment, materials, and labor can be quickly adjusted to take care of critical points.

Replacing Assault or Blown Bridges with Tactical Bridging. Tactical bridging is one of the most important tasks of the nondivisional engineer combat units. The corps engineer combat battalion must be well trained in the erection of the equipage of the engineer bridge companies and in the

construction of other types of bridges, including expedient bridges. Since assault bridging usually is needed urgently in other forward locations, the emplacement of tactical bridging is critical.

Tactical bridging is replaced as soon as possible with semipermanent fixed bridges, fills, or culverts. The bridge company may assist in dismantling the tactical bridge and removing it from the site, but a corps engineer combat battalion normally is responsible for this work.

For further discussion of bridges, see appendix F.

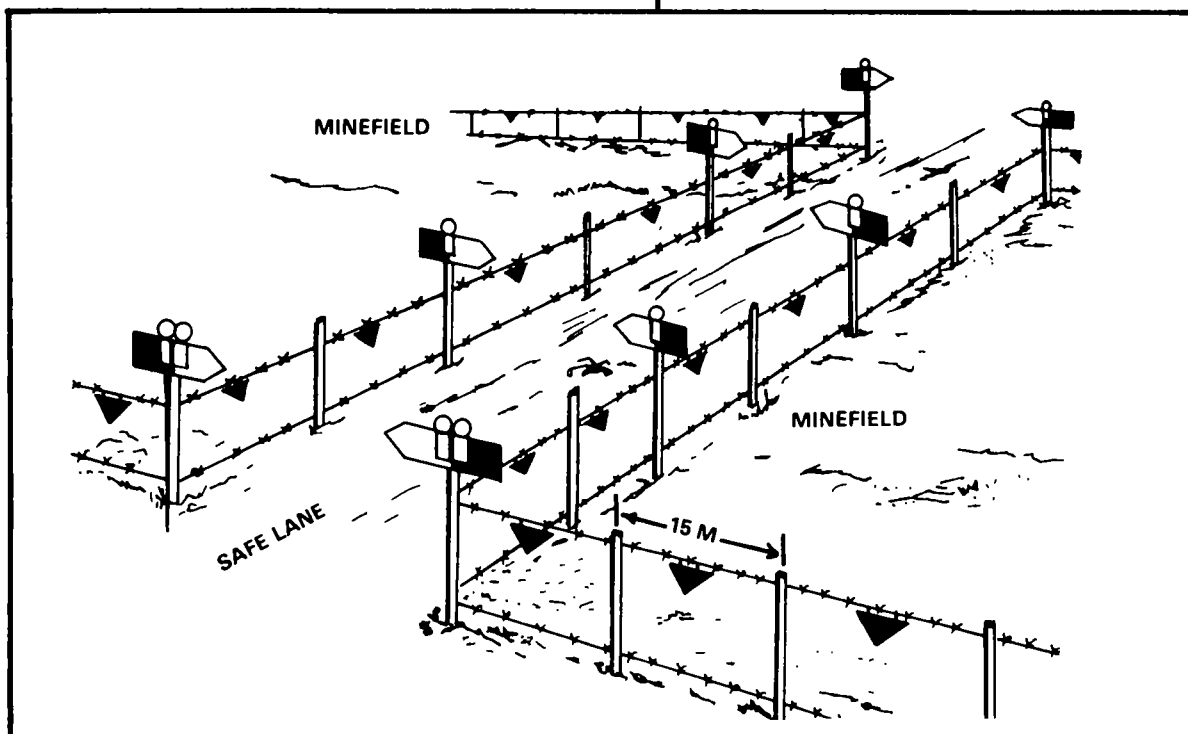
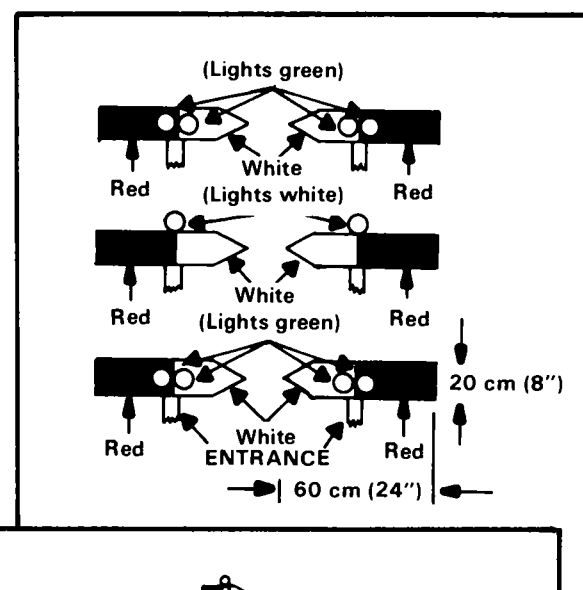
Clearing Minefields. Once breaching forces have opened lanes through the minefields and the attacking unit has moved through, responsibility for further work to enlarge the lanes and improve marking will pass to engineers doing general engineering tasks. Top priority will be given to establishing and marking minefield boundaries and to widening and marking lanes.

Vehicle lanes are widened to at least 16 meters for two-way traffic. These are marked on both sides by the XM133 HEMMS or by standard lane markers or other visible means

and a wire fence. Normally, the XM133 HEMMS must be replaced by standard lane markers after 15 days unless the batteries in the HEMMS unit are replaced. Routes of approach and exit are clearly marked.

The location of the enemy minefield will be recorded on the standard minefield form (DA Form 1355) and forwarded through channels to corps and other units as prescribed by unit SOPs.

Corps engineers also control passage of military vehicles through the mined area. For further discussion on traffic control, see FM 20-32.



Developing Forward Support Areas for Rearming and Refueling. A limited capacity for construction of forward area airstrips and helipads exists within the divisional engineer battalion. As a general rule, however, the development of forward area airstrips and helipads beyond a rudimentary combat facility will be accomplished by corps engineers.

Construction performed is the minimum necessary to accomplish the mission. Tasks include land clearing, grading, installation of airfield membrane and landing mats, installation of lighting and control facilities, construction of refuel and rearm points and protective berms, and development of hardstands for loading and unloading cargo.

Repair of combat damage to existing airstrips, to include replacement of membrane and matting, filling of craters, and debris removal, is within the capability of division engineers. However, extensive damage repair should be accomplished by corps engineers.

Providing Potable Water. The operation of water points is the responsibility of the division engineer battalion S4. Within the battalion S4 section, there are five water production teams each equipped with a water purification set, organic transportation, and enough personnel to operate and maintain equipment. These teams produce potable water for the division.

Normally, one team provides area support in each brigade area base, one team provides area support in the division area base, and one is kept in reserve.

Water usually is obtained from local sources determined by reconnaissance conducted by S2 personnel. The engineer companies assist in site preparation which includes clearing, construction of access roads, and necessary leveling and excavation to make the sites suitable.

When a source of water is not available in the division area, the division engineer has the staff responsibility for obtaining water elsewhere and stocking it at division water points.

Water point locations are reported to the supported brigade and to the engineer battalion and to the engineer battalion headquarters. Battalion, in turn, reports these locations to the G4. Each unit of the division draws water from the point nearest it.

The tactical situation and the sources of water normally dictate the location and hours of operation of water points. Normally, units are permitted to draw water at any time the water point is in operation. If water is limited in quantity or the demand excessive, units may be permitted to draw water only at scheduled times. Normally, the G4 establishes these schedules.

The engineer battalion S4 is responsible for coordination of displacement of water points with the water point teams and with the G4 for closeout times of old points and opening times and locations of new points. The S4 also is responsible for coordinating with the engineer battalion S3 for preparation of water point sites, and with the provost marshal for traffic control.

Providing Terrain Studies. The division engineer furnishes timely information or intelligence about obstacles, field fortifications, camouflage, routes of communication in the division area, and those aspects of the terrain not provided by the engineer terrain support element.

The terrain support element is in direct support of the division. It works under the general staff supervision of the G2 and under the special staff cognizance of the division engineer.

The terrain support element, with the support of the corps terrain team and the corps cartographic company, can provide studies and information pertaining to certain aspects of the area terrain. Information on area trafficability, location and suitability of river crossing sites, lines of communication, hydrography, possible water point locations, and location of engineer construction materials is found in such terrain studies and related reports. Therefore, it is essential that intelligence collection sources be coordinated

and that the engineer battalion S2 and the reconnaissance teams maintain close interaction with the terrain support element.

FIGHTING AS INFANTRY

The battlefield requirements for an engineer unit to assume infantry missions is rare. Such a requirement is more probable in defense than offense. A divisional engineer battalion might be given a mission to assist other combat forces in securing a critical objective. A mission to destroy an enemy strongpoint (such as a small bypassed enemy unit) is less likely than the mission to secure a critical objective.

For a detailed discussion of the infantry mission, see appendix D.

COMMAND AND CONTROL

All engineer activities in the division area of operation will be coordinated or directed by the division engineer, who advises the division staff on battalion employment during the offense. The division engineer's employment concepts are conveyed to all tactical commanders through the division operations order in the Task Organization and Execution and in the Engineer Annex.

During the planning of division offensive operations, the ADE will be the division point of contact for engineer matters and should be located at the division main command post. The ADE will:

Provide timely coordination with division staff.

Prepare engineer input to division OPORDs and OPLANs.

Provide assistance in preparation of plans and annexes for river crossing operations.

Provide information to the engineer battalion commander and staff to keep them aware of actions throughout the division.

Provide engineer evaluation of terrain.

In addition to the engineer battalion organic to the division, corps combat engineer battalions and other engineer elements will be working in the division area. These units normally are in direct support or general support of the division; however, their activities are coordinated by the division engineer.

The control of engineer activities in the division area can be subdivided into:

Control of engineer support to brigades.

Control of general engineering work.

Control of Engineer Support to Brigades. Each committed brigade will normally have one division engineer company in *direct support* except when that commitment is:

As a covering force in a movement to contact.

To conduct a pursuit.

To conduct a limited objective operation such as a reconnaissance in force or a raid.

For the excepted cases, engineers normally are *attached* to maneuver units because time and/or distance factors prohibit control by the parent engineer unit.

At the brigade, the normally associated engineer company commander is the brigade engineer who coordinates or directs all engineer activity in the brigade area.

When continuing requirements exceed the capabilities of one company, additional resources from either the division engineer battalion or supporting corps engineer units are placed under the control of the brigade engineer. A task force may be formed to control the engineer effort if the number of engineers in the brigade area exceeds the coordinating capability of the normal brigade engineer. The commander of this task force/battalion assumes the job of brigade engineer from the normally associated engineer company commander.

Platoons of this engineer element may be placed in any of the command or support relationships when supporting an infantry or armor task force. Historically, one platoon is capable of providing the engineer effort required in support of one committed battalion. However, for an offensive operation involving major breaching operations, assault of strongpoints, MOUT, or river crossing more engineers (in proportion to committed maneuver units) will be required. Examples of how these engineers may be utilized for some specific operations are:

Integrated with the maneuver platoons for breaching of personnel lanes or MOUT operations.

Organized in special teams under battalion/brigade control for breaching of vehicle lanes.

Organized for company/battalion operations such as when an engineer battalion is operating crossing means for the crossing area commander. In such a case, these engineers would be under control of brigade or higher headquarters.

The engineer should be represented at the brigade headquarters. Normally the brigade engineer accompanies the brigade commander and inspects the status of engineer work.

The brigade engineer will designate a

liaison officer to coordinate engineer activities with the brigade. Normally, the company executive officer is designated to perform the liaison functions. The liaison officer is familiar with the capabilities and operations of both units and keeps informed on all plans and operations to give reliable and up-to-date information and advice to both commanders.

Control of General Engineering Work. Engineer units, including corps units, not in direct support of brigades are responsible for general engineering work in the division area. This work is coordinated and controlled by the division engineer with the ADE being the chief liaison agent between the engineer battalion and division headquarters.

Engineers are tasked to do general engineering work by specific task assignment or by area assignment.

When requirements in the division area exceed the capabilities of the division and the corps supporting engineer, the division engineer should request the assistance of a corps engineer group. The division engineer coordinates with the corps engineer for a corps engineer group to assume some of the workload in the division rear area. An engineer workline, established by coordination between the division engineer and the corps engineer, controls the forward working limit of the corps engineer groups in the division's rear area. Engineer work forward of the engineer workline is the responsibility of the division engineer.

The following tactical situation illustrates how the division engineer battalion might fight with the combined arms team during a movement to contact and hasty attack.

Section V

OFFENSE SCENARIO

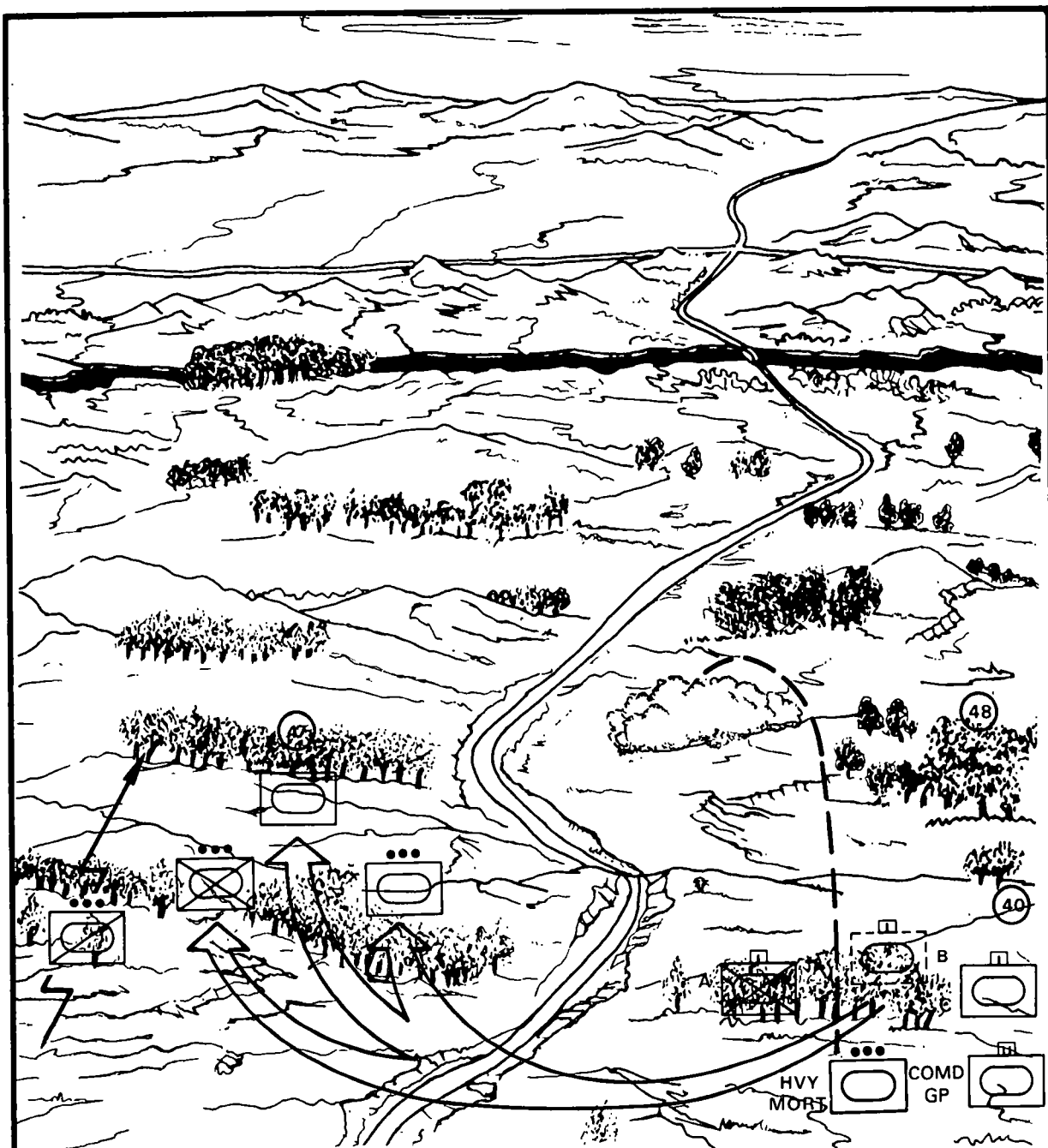
This scenario focuses on TF Alpha and its engineer platoon. *Fold out page 3-47 for terrain references while reading this scenario.*

Units of the 3d Brigade are task organized into TF Alpha and TF Bravo. Company C from the engineer battalion is in direct support of the brigade. The brigade engineer placed an engineer platoon in direct support of each task force. The first platoon has been tasked to fight with TF Alpha, and the second platoon has been teamed with TF Bravo.

Each engineer platoon has a CEV for knocking out obstacles and strongpoints. In addition, each platoon has its basic load of demolitions, mine detectors, and organic hand tools in their pioneer tool sets, plus a supply of bangalore torpedoes and M173 line charges to quickly conduct assault breaches through any enemy minefields encountered. (The tank companies

have their organic mine rollers available also.) Reconnaissance information from the intelligence officer indicated that bridges would probably be destroyed, so the brigade engineer requested two AVLBs from battalion operations before movement to contact began. One AVLB, in addition to the two AVLBs organic to the tank battalion, has been deployed with each task force.

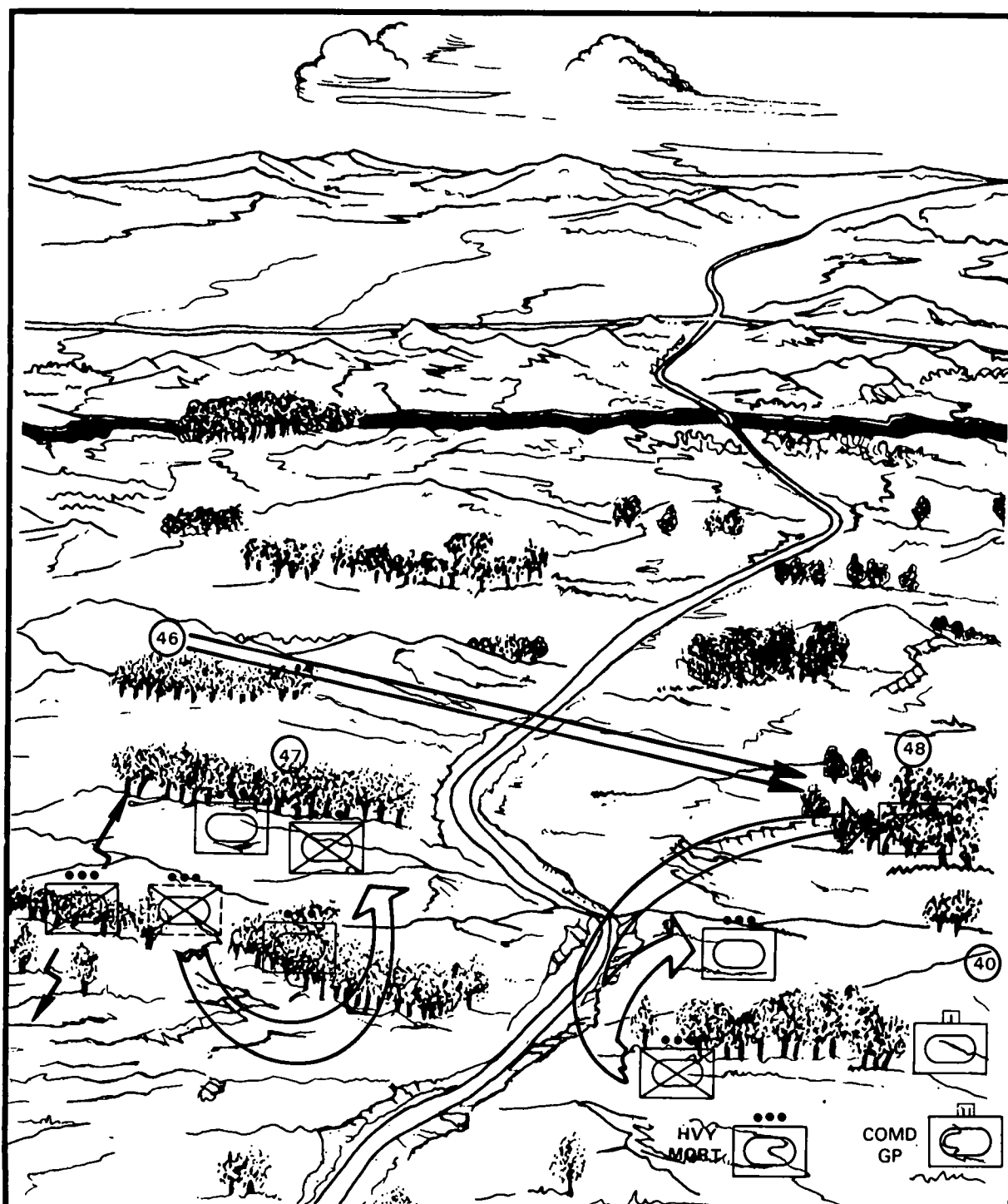
Equipment not needed by the leading elements has been placed in the brigade's trailing body for on-call missions. The engineer company (-) is moving with the brigade control group. Elements from the company (-) are available to reinforce the leading engineer platoons as required.



A tank-heavy task force organized into three tank-heavy teams is deployed as shown. The battalion task force has destroyed an enemy unit on the hill at checkpoint (CP) 40 and is ready to continue the attack to the north against scattered resistance. It is out of contact now, but contact is expected.

The commander orders movement to start. Team B is ordered to advance west of the road. The scout platoon will screen the west flank. The rest of the battalion task force will advance east of the highway, Team C leading, followed by the command group, mortar platoon and Team A.

Team B is shown moving across the highway and establishing overwatch with two platoons while a tank platoon starts to bound toward CP 47. The mortar platoon has moved up to the base of the hill at CP 40 and is placing smoke on the west end of hill CP 48 to screen the move of Team B's bounding platoon.



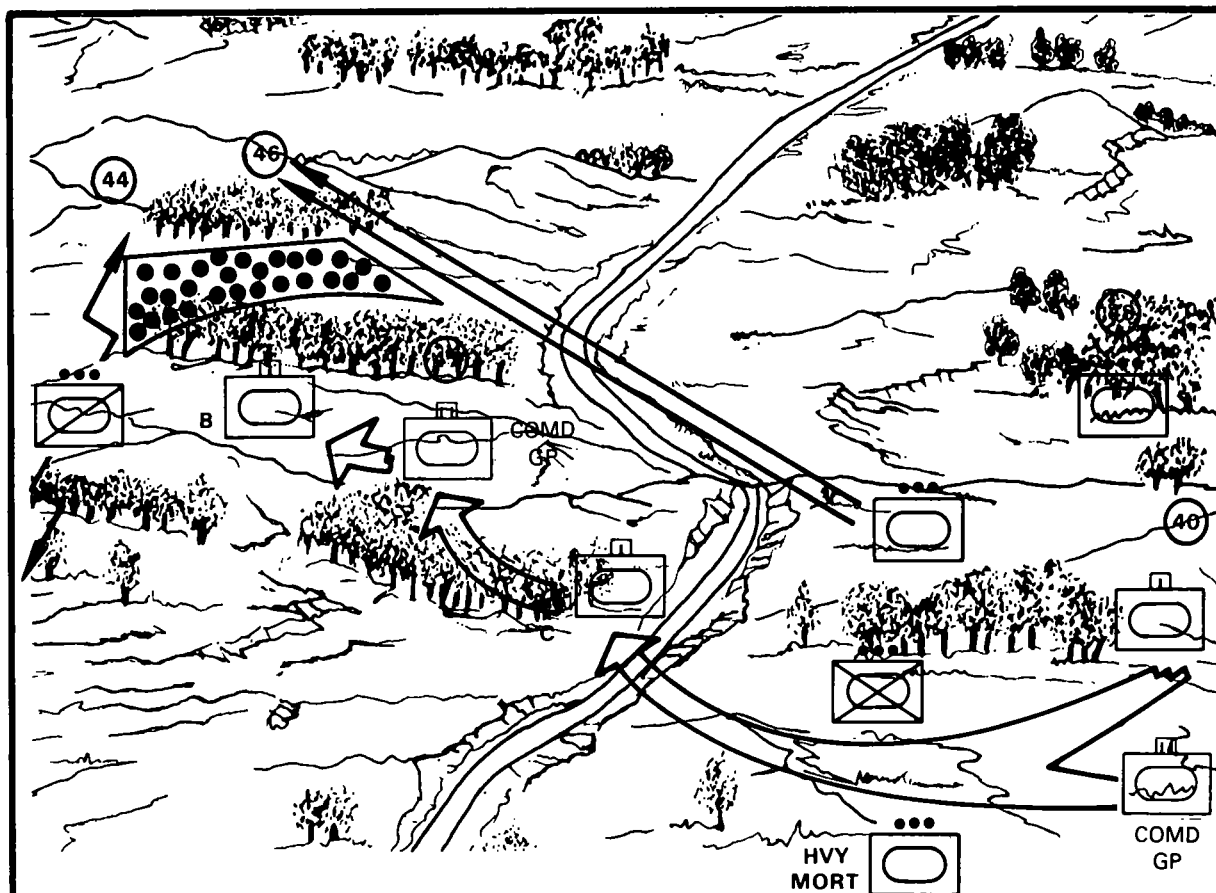
Team B: Leading platoon has gained the woodline at CP 47. Mech platoon has joined. These two are moving along the woodline prior to next bound toward CP 46. Second tank platoon is preparing to move to CP 47.

Scout platoon: Preparing to bound forward to maintain contact with rear of Team B.

Team A: Mech platoon and TOWs overwatching from west end of Hill CP 40. One tank platoon overwatching

along ridgeline half way to CP 48. Second tank platoon, bounding to CP 48, is engaged with missiles from vicinity of CP 46.

Team C: Overwatching from CP 40. Enemy mortar fire is falling along top of hill CP 40.



Team A commander directs return fire from his overwatching tank platoon, moves the bounding platoon toward CP 48 and cover, calls for artillery fire east of CP 46 and reports to the battalion task force commander. His report includes:

- Enemy fire is missile only, at a range of about 2000 meters.
- Hill CP 48 is unoccupied.
- Actions he is taking.

Team B commander reports CP 47 unoccupied; however, one of his tanks moving along the woodline has hit an antitank mine. He reports that the open area west of CP 47 extending to CP 44 appears to be mined.

The task force commander realizes he can bypass to the east but that enemy forces

control the road along which trains and other support must follow. He decides to use M173 line charges to open lanes through the minefield and to attack by envelopment to the left. He issues the following fragmentary order (FRAGO) by secure voice radio:

- Enemy minefield located south of CP 46.
- Enemy ATGMs located vicinity CP 46.

Engineers, prepare to breach four lanes with M173 line charges.

- Teams B and C will attack to clear enemy positions vicinity CP 46 as soon as lanes are opened Mortars fire smoke in front of CP 46 Fire support officer (FSO) continue fire on enemy. Team A forward observer (FO) adjust.

- Team B, begin your move on an axis west of CP 47 through CP 44 to attack toward CP 46.

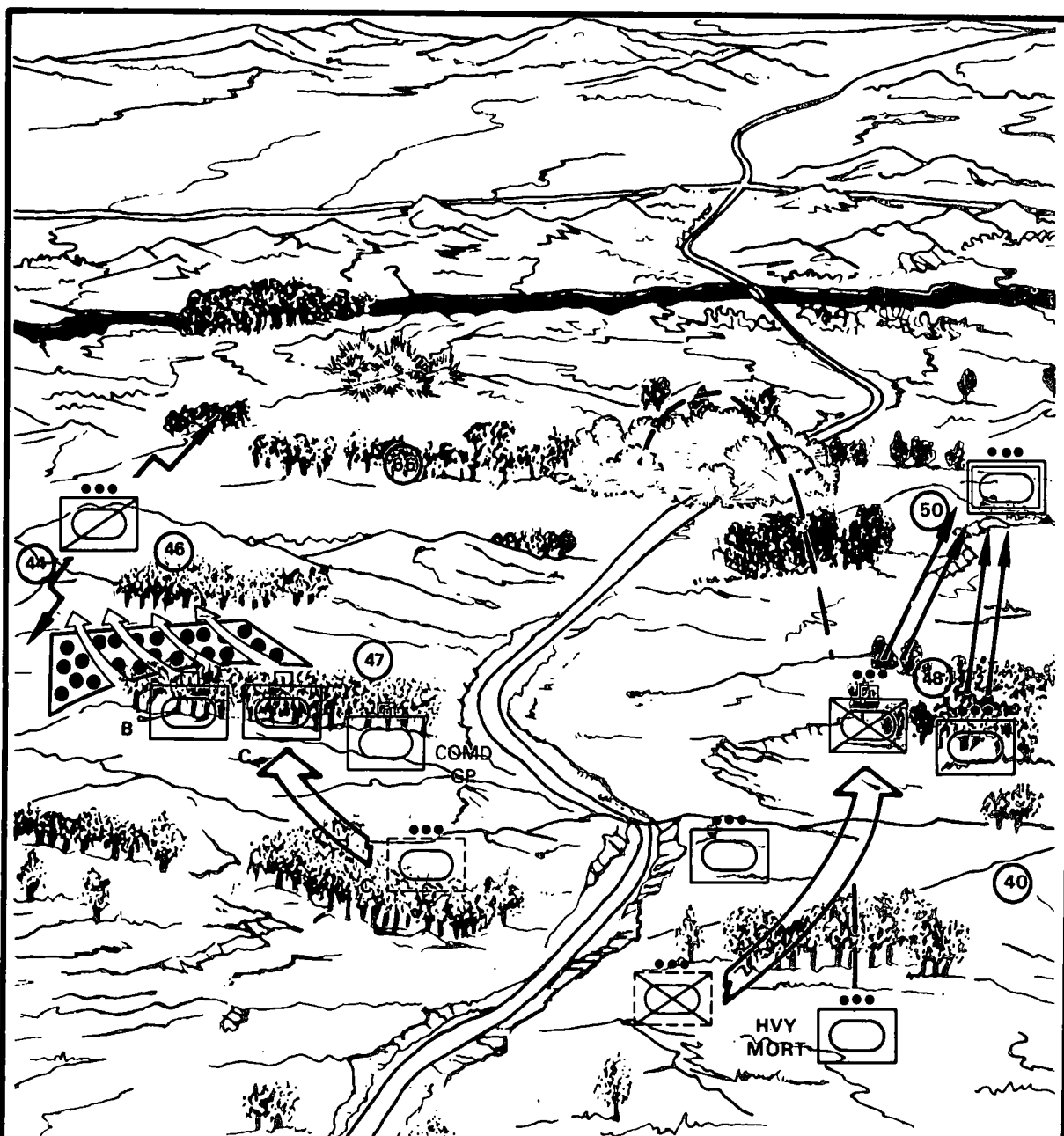
- Team C, follow command group to CP 47, move up on right of Team B to attack CP 46.

- Team A, guard right flank, continue to suppress CP 46 from present position.

- Scouts continue to screen left flank.

- I will follow Team B as far as CP 47, then follow Teams B and C. **MOVE OUT!**

The mortars begin firing smoke and the engineer platoon leader moves the M173 line charges into firing position.



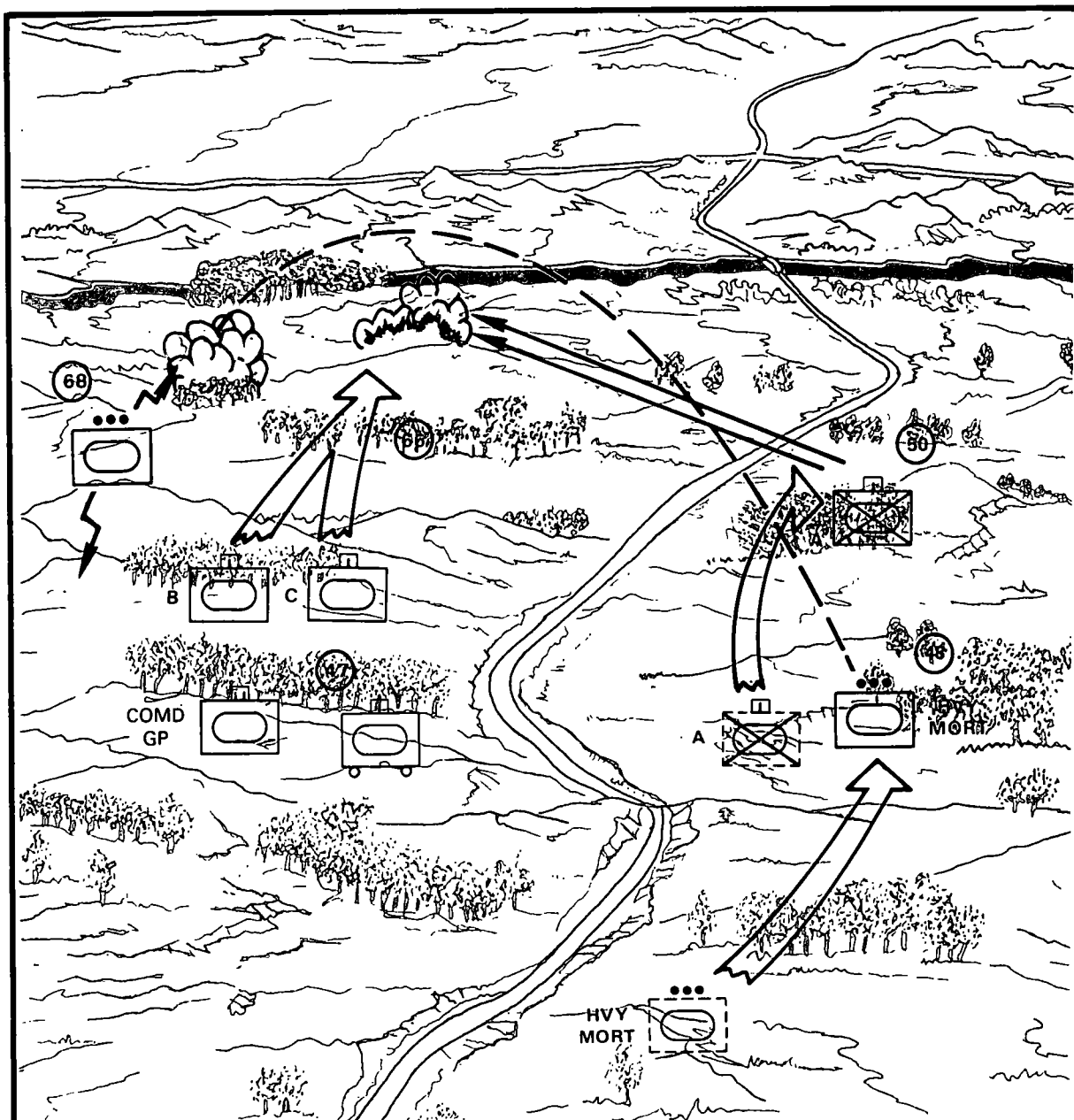
Four lanes are breached and, under cover of smoke, assault forces move quickly through the minefield. As Teams B and C move toward CP 46, engineers mark the lanes for following units using the XM133 HEMMS and report the field to brigade headquarters. Any mines not cleared by the engineers with the task force will be cleared by corps engineers later.

As Teams B and C move toward CP 46, the leading scout reports from CP 44 that enemy heavy mortars are firing from vicinity of CP 66.

The fire support officer shifts artillery fire from CP 46 to CP 66 to suppress these weapons. He shifts mortar smoke from the valley south of CP 46 to the saddle between CP 46 and CP 50 to screen the movement of

Teams B and C from observers beyond the saddle. Teams B and C, controlled by the battalion task force commander, assault and overrun the enemy position at CP 46 from the flank.

Team A commander reports an enemy tank platoon moving rapidly from the northeast toward CP 50. He engages and destroys it.

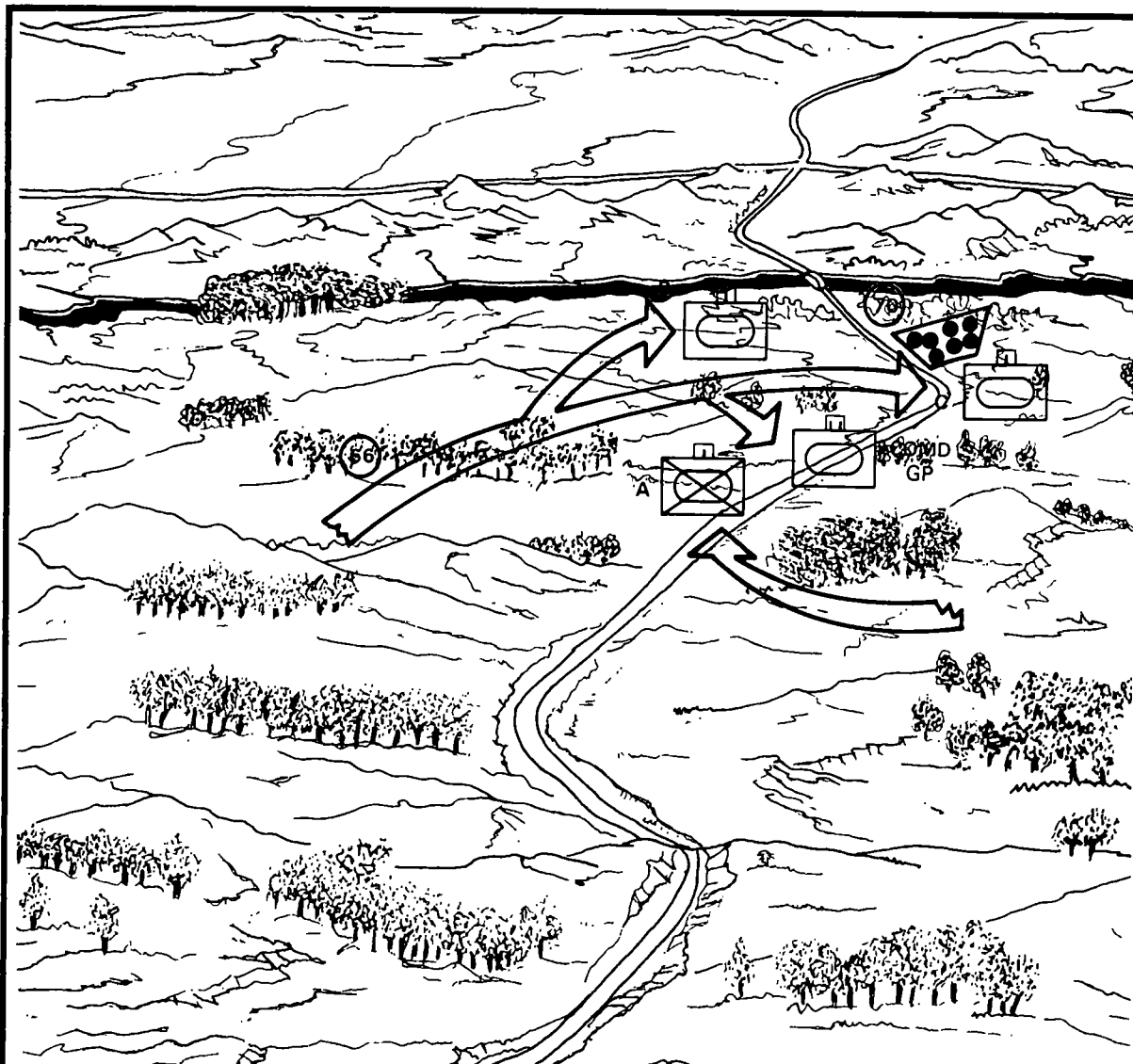


The battalion task force rapidly prepares to continue the attack. Supporting field artillery fire continues in the area of CP 66. Team A advances to CP 50. Teams B and C overwatch the move. Mortars of the weapons platoon of Team A place smoke in the saddle between CP 66 and CP 68 while the heavy mortar platoon displaces to CP 48. Portions

of battalion task force trains not already there are moving to CP 47. Disabled vehicles are dragged to the highway to be picked up by the battalion maintenance platoon.

In order to destroy the enemy fire support unit before it can escape, the battalion task force commander shifts artillery fire

north of CP 66, orders Team A to suppress from CP 50, and with Teams B and C he attacks toward CP 66. Each team has an engineer squad. The CEV is moving with Team B to assist them with knocking out obstacles encountered while passing through the woodline.



The battalion task force destroyed an enemy mortar battery at Checkpoint 66 and continued its advance to the north astride the road. Team B is on the left, Team C on the right, with Team A following Team C. **One AVLB is attached to Team C and the other two are with Team A.**

At CP 70, leading elements of Team C report that the ground ahead has been recently plowed and they suspect the roadway west of CP 70 is mined.

Engineers with Team C begin a quick recon of the area to confirm the presence of mines and to determine

the crossing conditions at the river.

The engineer platoon leader must quickly find answers to these two questions concerning the river crossing:

1-Can an AVLB be used?

The platoon leader knows that:

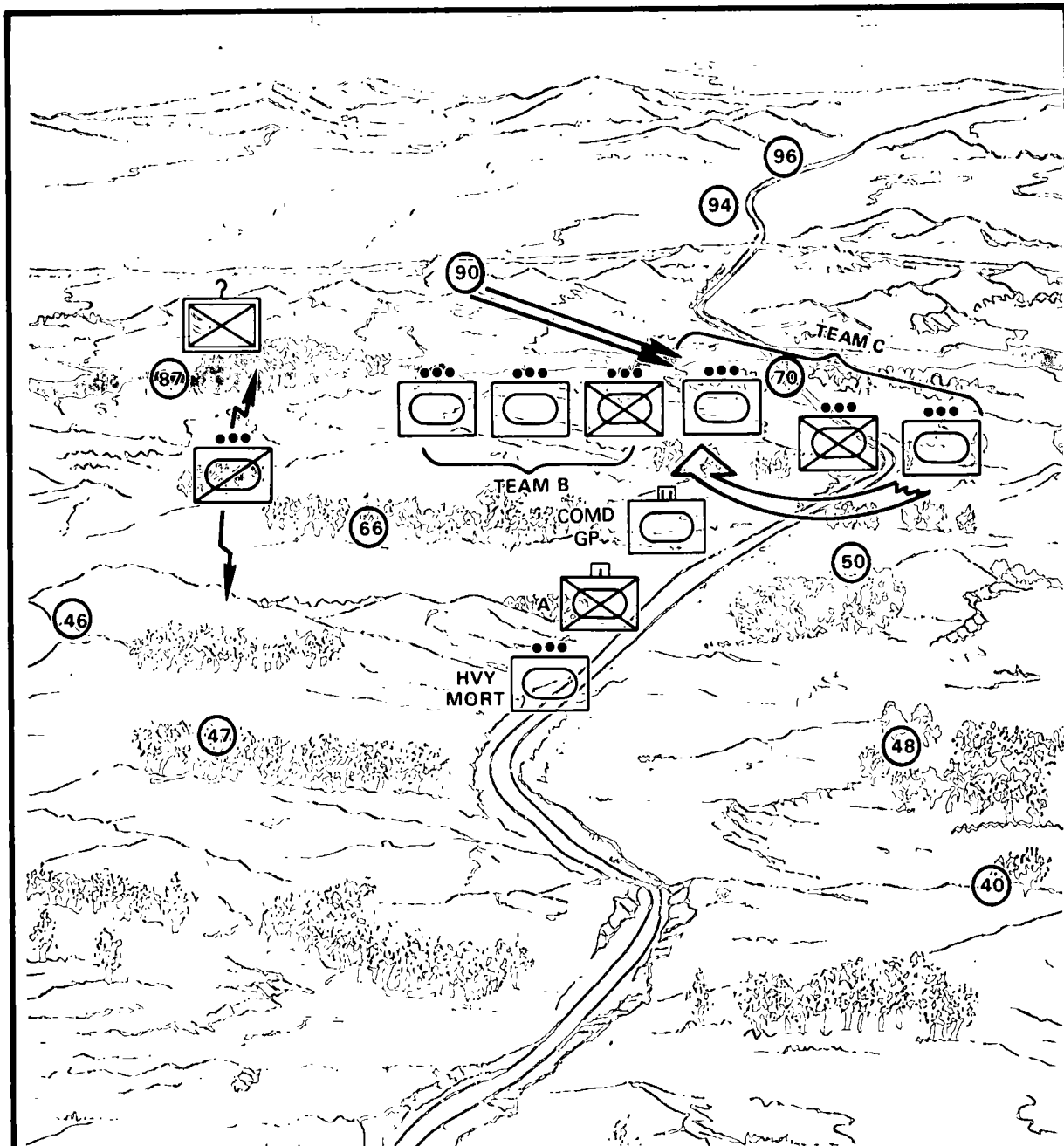
- *The gap has to be less than 57 feet.*
- *The approach area probably is mined and will have to be cleared.*
- *The bridge probably is covered by both tanks and ATGMs.*

- *Friendly suppressive fires and smoke will be needed.*

2-Can the gap be forded?

The platoon leader knows that:

- *The depth of water has to be less than 1 meter.*
- *The access and egress points have to be at least 5 meters wide and not exceed a 2:1 slope.*
- *The potential sites probably are mined and covered by fire.*
- *Friendly suppressive fire and smoke will be needed.*



Team B is overwatching the movement of Team C from CP 71 due to the long fields of fire around the bridge. As Team C moves toward the bridge, they receive fire from across the river. Team C commander returns fire, calls for mortar and artillery fire, seeks cover, assesses the situation, and reports:

● *Enemy fire is 73mm and 7.62mm.*

● *No other enemy activity detected.*

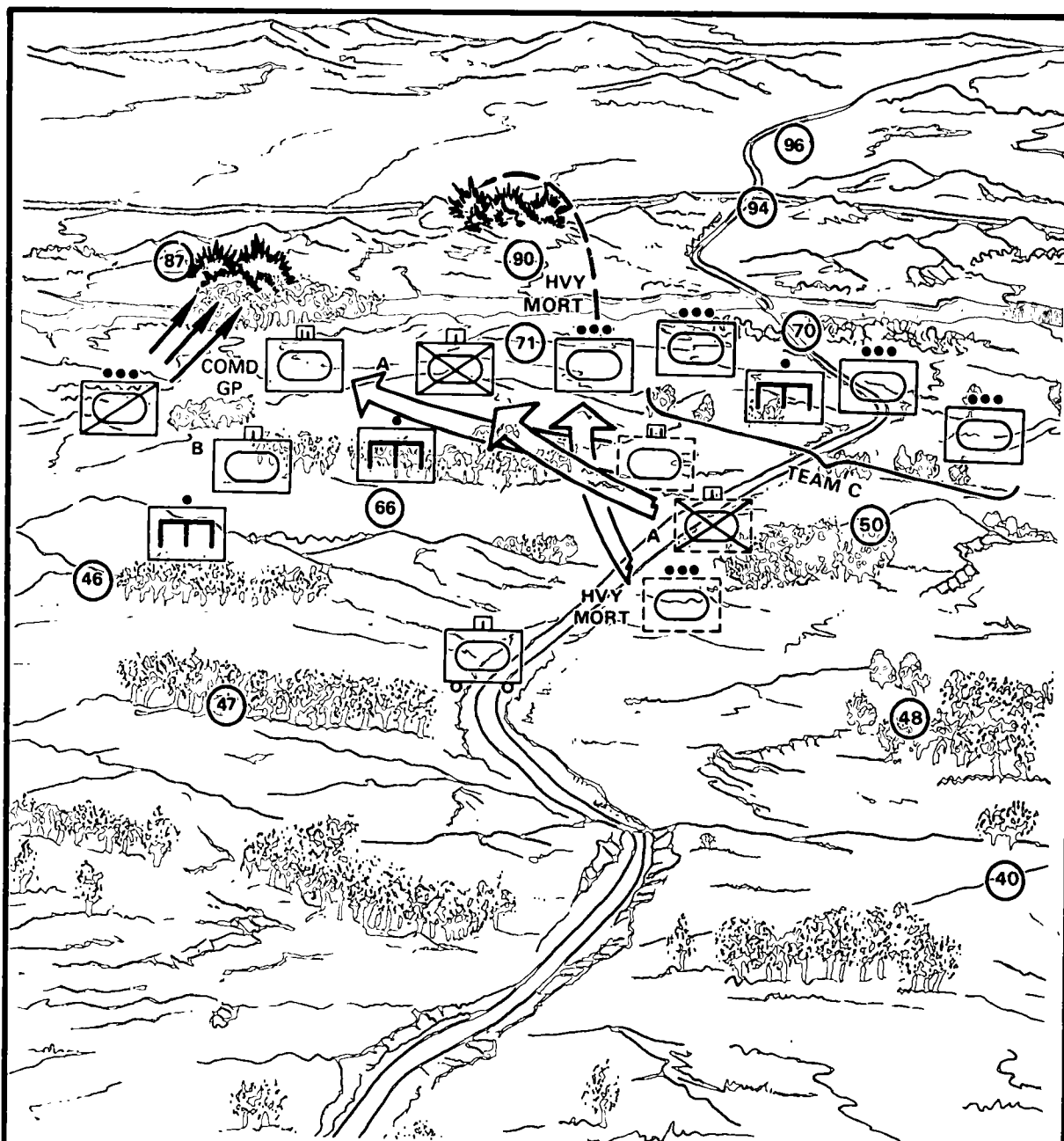
● *The bridge is out.*

● *The river is unfordable, swimmable, has good banks, and can be spanned by AVLB.*

● *Action he is taking.*

Scouts report an infantry element of unknown size at CP 87 at the base of the hill. The battalion task force

commander decides he cannot bypass. Envelopment right is difficult due to openness of terrain around the river and the distance an assault force would travel to CP 90. Envelopment left is possible, but complicated by enemy forces west of CP 87. The unfordable river requires an assault force of pure mechanized infantry initially. The commander decides to attack on the axis CP 71 to CP 87 to CP 90.



The TF commander:

- Requests artillery fire on the enemy infantry at the base of CP 87.

- Orders Team C to detach its mechanized infantry platoon to Team A, protect the right flank, and suppress enemy direct fire weapons during the infantry river crossing.

- Orders Team A to detach its tank platoon to Team B, receive attachment of all infantry platoons, and attack toward CP 87.

- Orders Team B to detach its mech platoon to Team A, receive attachment of A's tank platoon and two AVLBs, and follow Team A (now Company A) across the river to enemy positions. Sup-

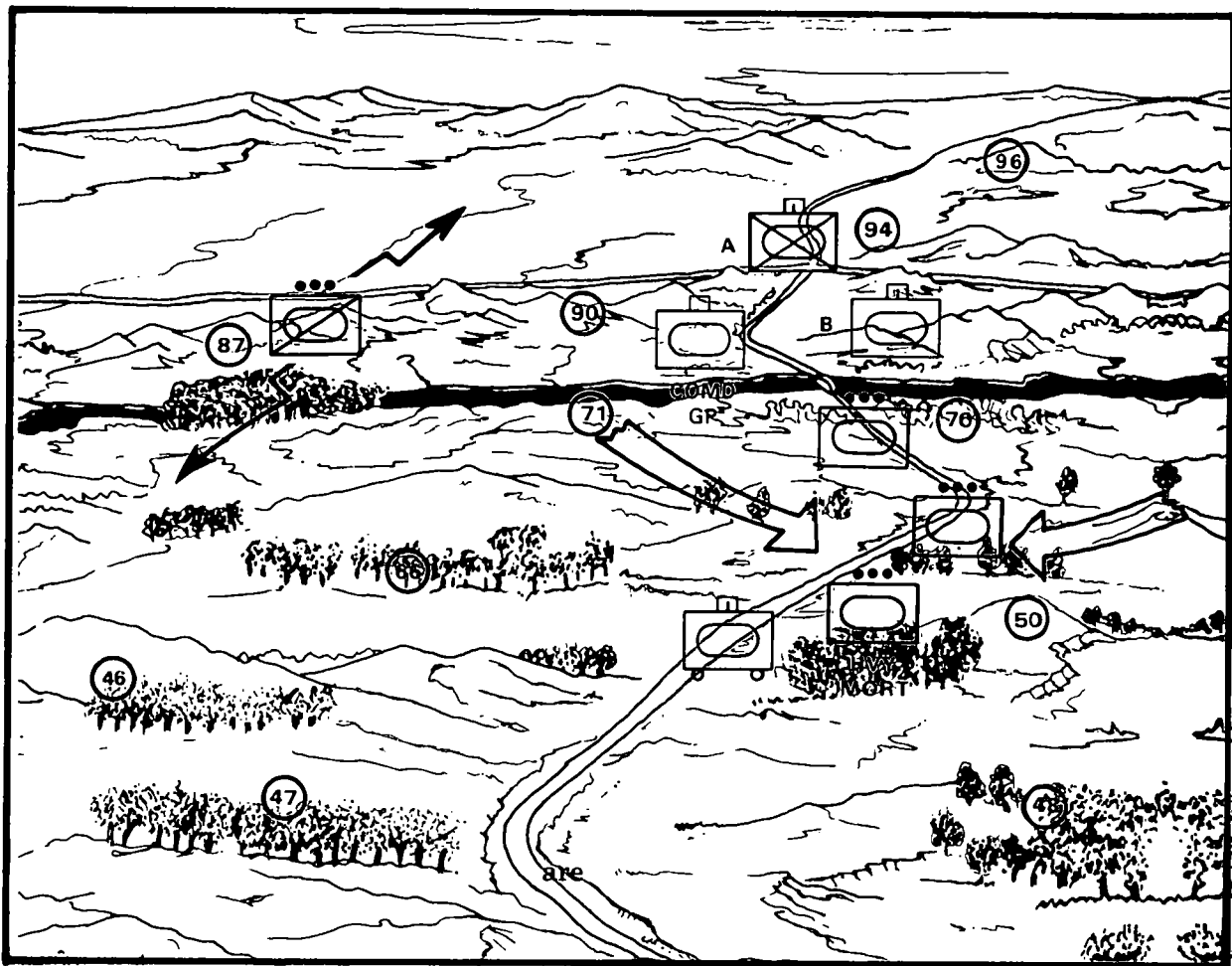
press for Company A during the crossing.

- Orders scout platoon to advance a section toward the enemy infantry and suppress them with direct fire.

The engineer platoon leader and two squads will move with Companies A and B, leaving one squad with Company C.



The task force commander quickly revises the task organizations of A and B. Leaving two tank platoons to overwatch near CP 90, he orders Team B to continue rapidly to the east to secure the key terrain at CP 94. Company C (-) also overwatches this move. Mortars continue to smoke to cover movement.

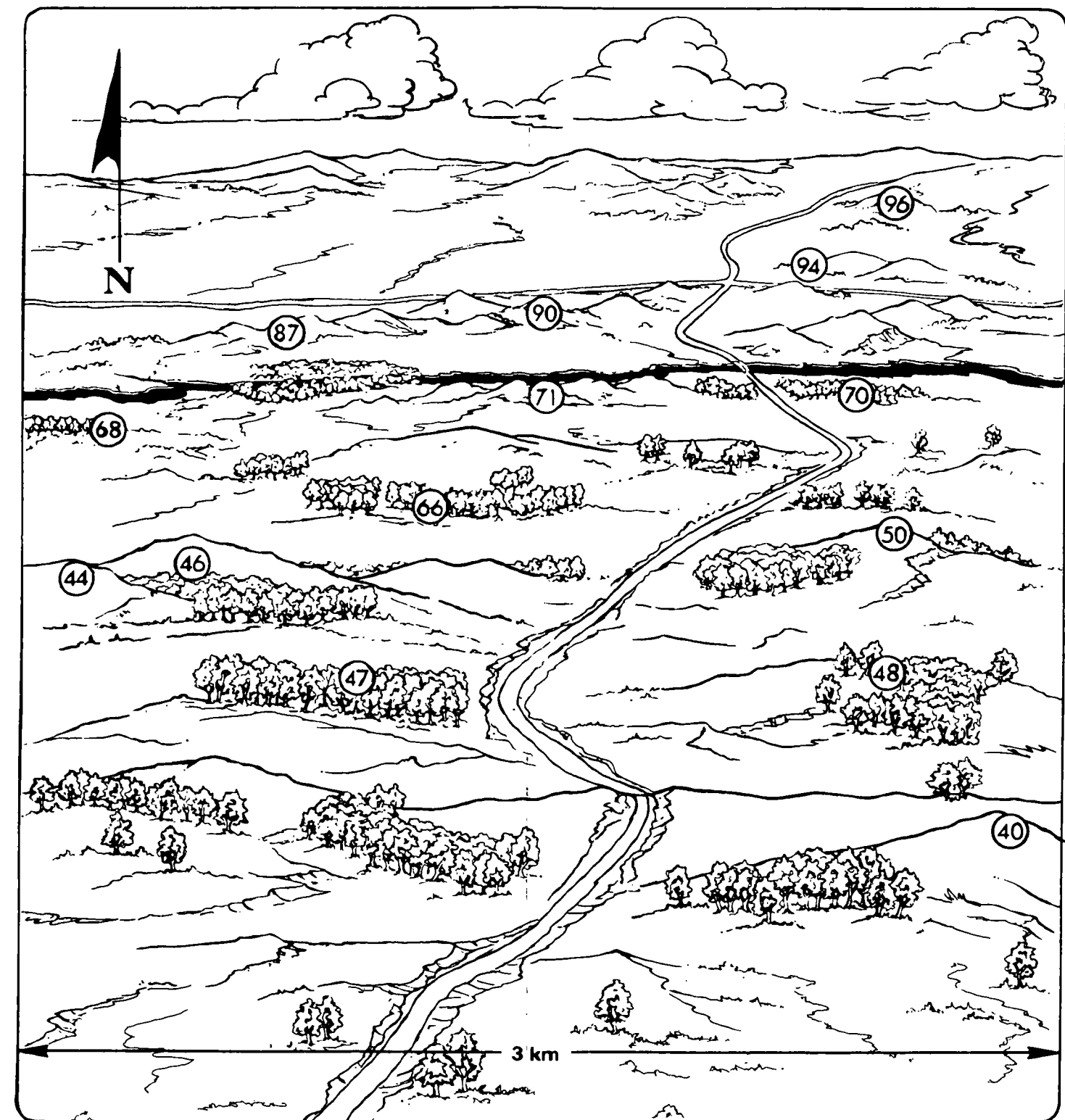


Having destroyed enemy forces in the immediate area, the task force undertakes several actions. It consolidates its positions on the north side of the river so as to be ready in case of enemy counterattack. Radars are emplaced to scan the area. Redeyes are deployed to cover air avenues of approach. The engineer squad with Company C clears the road of mines, marks the lanes, and directs the launching of the third AVLB near the blown highway bridge so that the remainder of the task force can cross. After the task force has crossed, the brigade commander directs the TF commander to recover the two AVLBs launched south of CP 87 but to leave the AVLB near the blown bridge until other brigade elements following the task force have crossed.

Information concerning the stream's

potential for a possible water point in the brigade's area and the requirement for tactical bridging is passed to the brigade engineer for relay to the division engineer. Planning can then be completed on tasks to be done by corps engineers to cross follow-on elements of the division. Any tactical bridging emplaced will require improvements in the bridge approach and exit.

Medical aidmen with company teams treat or evacuate casualties as necessary. Damaged vehicles are repaired or towed to the highway to be taken over by the battalion maintenance platoon. While these activities go on, the commander directs that platoons be refueled and resupplied with ammunition, and briefs his company team commanders on continuation of the operation.



Chapter 4

DEFENSE

The engineer role in the active defense is to employ the terrain to increase the combat effectiveness of our maneuver forces by enhancing their mobility, countermobility and survivability while simultaneously impairing the mobility of the enemy. These actions allow us to target the greater number of the enemy or to locally economize our forces in order to fight and defeat a numerically larger force.

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Section I

INTRODUCTION

ATTACK IS A VITAL PART OF ALL DEFENSIVE OPERATIONS

PURPOSE

DEFENSIVE OPERATIONS are undertaken to:

Cause an enemy attack to fail.
Preserve forces, facilities, installations, and activities.
Retain tactical, strategic, or political objectives.
Gain time.
Concentrate forces elsewhere. (Economy of force)
Wear down enemy forces as a prelude to offensive operations.
Control essential terrain.
Force the enemy to mass so that he is more vulnerable to our firepower.

While it is generally true that the outcome of combat derives from the results of offensive operations, it may frequently be necessary, even advisable, to defend. The defender has many advantages. In fact, the defender has every advantage but one — he does not have the initiative. To gain the initiative he must ATTACK.

CONCEPT OF THE ACTIVE DEFENSE

The concept of the active defense is to capitalize on the mobility of the maneuver and fire support systems of the division to concentrate sufficient combat power at the decisive time and place.

The defense is designed to defeat an enemy who has superior numbers of men and material at least initially. The defensive system cannot be equally strong across the entire front. Therefore, locating the enemy's main thrust is essential to success. The division must remain flexible, have its forces organized, and be prepared to react to concentrate favorable force ratios of at least one to three (defender to attacker) against the enemy main thrust. This concentration requires acceptance of risks in less threatened sectors. The division maximizes the effectiveness of its weapon systems and exploits all the advantages of the defender.

By the deployment of strong combined arms forces well forward and in depth

throughout the defensive sector, the defender continuously wears the attacker down by confronting him early and successively from prepared positions.

In an active defense, battalion task forces and subordinate company teams may *engage the enemy from battle positions* and when appropriate, *move to other battle positions*, or establish strongpoints around which the battle can *pivot*.

The defender must utilize every advantage offered by the terrain. Some examples of proper use of terrain advantages follow:

Use existing obstacles that can be strengthened and extended by reinforcing obstacles and can be integrated with observed fires.

Examine approaches to find areas where enemy formations can be subjected to a high volume of lethal fires.

Develop obstacles which tend to force an attacking enemy away from cover and concealment and into open ground (high priority).

Select battle positions which provide:

Long range, unobstructed fields of fire into likely enemy avenues of approach.

Cover from the fires of following enemy echelons.

Concealment or nearby concealment.

Adequate routes in and out so that units can occupy and vacate quickly.

Positions are chosen from which long range fire can be delivered at ranges optimum for the weapons which will be used there. The goal of the active defense is to permit:

TOWs and missile firing tanks to engage enemy forces near the 3,000 meter range.

Conventional tank guns to engage at about the 1,500 meter range.

Dragons to engage as near as possible to their maximum effective range (1,000 meters).

To *capitalize* on their range advantage over the enemy and to engage him as early as possible, TOWs and *missile firing tanks* *initially engage* the enemy with frontal fires. As the enemy approaches closer, our weapons take up *terrain-masked positions* from whose relative protection they deliver *flanking fires*. Weapons engage an enemy from one set of firing positions, then move to alternate positions or to new battle positions as the enemy fires and maneuvers in return. *Capitalizing on surprise fire and first shot advantage*, each weapon in range must hit one or two vehicles in each engagement and move before the weight of effective return fire can fix it in position and destroy it. With field artillery, mortars, and close air support providing suppression and additional destruction, a battalion task force can destroy, contain, or drive out successive enemy attacks.

While the active defense is designed primarily to defeat mounted attacks and enemy formations attempting to bypass obstacles and other areas, it can be adapted to dismounted enemy attacks as well. If enemy troops dismount, one of two things will result:

1-Enemy assault forces must slow to the pace of the dismounted troops, thereby increasing the time his vehicles can be engaged by our weapons, or

2-Enemy tanks will become separated from their infantry, again increasing their vulnerability.

In either case, the dismounted troops are more vulnerable to field artillery, mortar, and direct fires. As infantrymen are eliminated from a formation, the enemy tanks become more vulnerable to surprise fires from all antiarmor weapons.

FUNDAMENTALS OF THE DEFENSE

- 1- Understand the enemy.**
- 2- See the battlefield.**
- 3- Concentrate at the critical times and places.**
- 4- Fight as a combined arms team.**

5- Exploit the advantages of the defender.

1- Understand the Enemy. Every commander must study the weapons, tactics, and techniques of the enemy. The enemy's strengths and weaknesses must be known. The engineer must be able to provide information on the Threat's counterobstacle capabilities and the Threat engineer's vulnerabilities.

2- See the Battlefield. To know where to concentrate combat power at the critical place and time, the tactical commander must have detailed knowledge of enemy organization, strength and dispositions, and accurate and detailed information about the terrain. The engineer will provide terrain analysis information to help the commander understand the terrain.

3- Concentrate at the Critical Times and Places. The defender must be able to concentrate enough forces to destroy the masses of enemy armored vehicles in the assault. The engineer, by improving the mobility of the forces being concentrated, contributes to their arrival at the right time and place on the battlefield.

4- Fight as a Combined Arms Teams. Field artillery, air defense artillery, tactical aircraft, engineers, infantry, tanks, and attack helicopters each have a vital contribution to make. Each must be used in combination with others so that the strengths of each are maximized and their vulnerabilities are minimized. Engineers

increase the combat effectiveness of the other team elements. Engineers:

Enhance friendly mobility.

Impede enemy mobility.

Enhance survivability.

Fight as infantry.

The engineer system provides the specialty to do the first three tasks and can, when required, hold or seize terrain.

5- Exploit the Advantages of the Defender. The success of the defense ultimately will depend greatly on how well the combined arms team exploits all the built-in advantages of the defender. The engineer exploits the defender's advantage through the *countermobility tasks* of:

Stopping enemy forces in the fields of fire of defending weapons with obstacles.

Blocking avenues of approach.

survivability tasks of:

Undertaking combat construction to dig in and harden antitank weapons, critical command, control and logistic elements.

Improving battle positions.

and the *mobility* task of:

Opening forward and lateral tactical routes.

Section II THREAT OFFENSE

When planning and preparing for a defensive mission, the tactical commander must consider the enemy's capabilities, limitations, intentions and tactics. These factors together with the friendly forces' assets and the tactical commander's plan to win the first battle, will play a major role in determining how the engineers will assist in establishing the defense.

FUNDAMENTALS OF THE THREAT OFFENSE

In the offense, the Threat advocates the concentration of numerically superior forces and firepower for a combination of frontal attack, enveloping maneuvers, and deep offensive thrusts into the enemy rear by armor heavy combined arms forces. The Threat anticipates achieving an offensive momentum which will allow his forces to advance 30-50 km a day in a conventional environment and 60-100 km a day in a nuclear environment. In order to support and maintain a high-speed advance, the Threat stresses the importance of attacking from the line of march. A deliberate attack generally results when a hasty attack fails to destroy the resistance.

To the Threat force, the key to successful offensive action is to gain momentum early and, once gained, maintain the momentum until decisive victory is achieved. *Armored and motorized units* are the heart and soul of the Threat army.

Defending units will be bypassed by divisional first echelon forces, when possible, in order to maintain forward momentum. Pockets of resistance bypassed by first echelon units will be engaged by divisional second echelon forces or forces from higher command levels.

Large flank and rear security forces are not maintained since the Threat considers rapid advance as the best solution to peripheral security.

River crossings are considered a normal part of offensive operations. The Threat will conduct hasty crossings *from* his line of march whenever possible.

The Threat recognizes three basic forms of offensive action:

- 1- **The meeting engagement, which includes advance to contact and hasty attack;**
- 2- **The deliberate attack or breakthrough; and**
- 3- **The pursuit (exploitation).**

1- The Meeting Engagement. The meeting engagement, i.e., the collision of two opposing forces, is stressed more heavily in Threat military writing than any other form of offensive action. Because of the fluid nature of modern war, the Threat believes that the meeting engagement will occur more often than any other type of combat action. Meeting engagements are characterized by:

Action to seize and maintain the initiative.

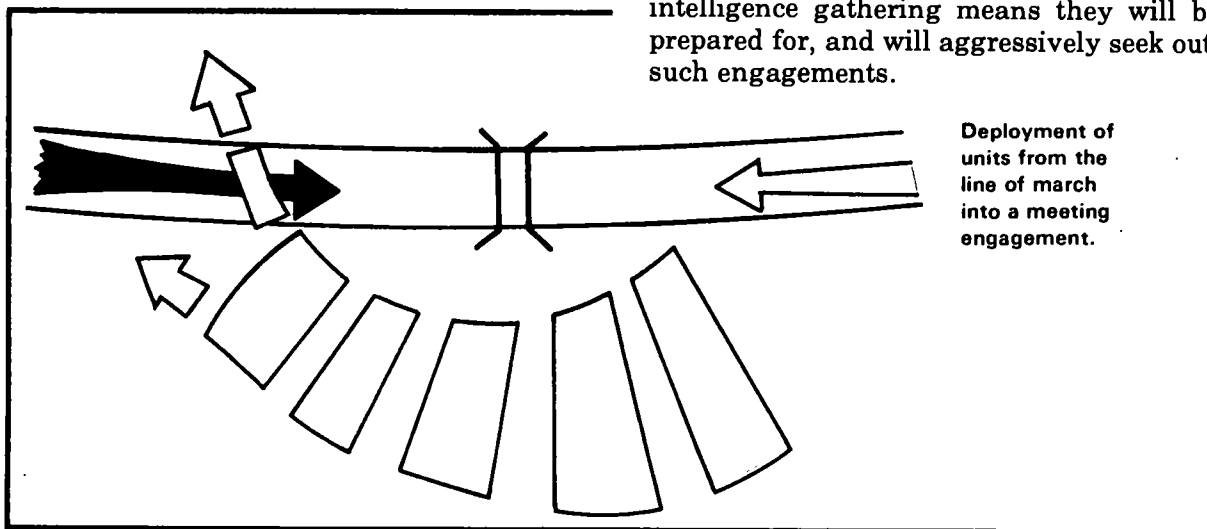
Development of combat on a wide front with freedom of maneuver and the presence of open flanks.

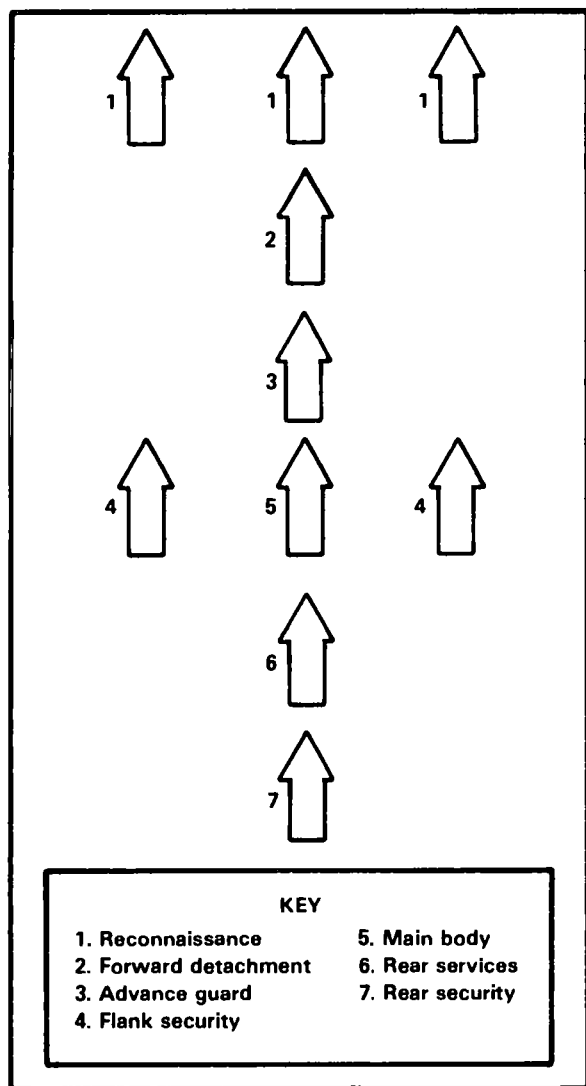
Rapid deployment of troops, chiefly from column.

Mobile high-speed combat.

Often incomplete intelligence concerning enemy forces in many cases.

The Threat believes that it is both possible and necessary to anticipate meeting engagements; that through various intelligence gathering means they will be prepared for, and will aggressively seek out, such engagements.





Advance to Contact. The Threat normally advances to contact against an enemy as shown at left.

A Threat division normally will use at least two or more main routes of advance. In each route, motorized reconnaissance elements will lead the movement. Each forward regiment of the division organizes an advance guard normally constituting a reinforced battalion. The role of the advance guard is to overcome local opposition, particularly antitank weapons, and it strives to keep the main body moving. If unable to overcome or bypass opposition, the advance guard will cover the deployment of the main body for an attack.

Threat forces in the advance to contact normally move in column formation to support their high-speed advance doctrine. Deployment into various battle formations is conducted by successive advancing elements only to the extent necessary to overcome enemy defensive positions.

Hasty Attack. The hasty attack is normally an extension of the meeting engagement. It is conducted when enemy prepared positions are encountered and Threat forces have quickly located an assailable flank or gap in the enemy defenses. Threat forces will deploy from the march column and attack without halting in the belief that the disadvantage of a hastily planned and executed attack is more than offset by the advantage of striking an enemy who has not adequately completed his defensive plans.

2-The Deliberate Attack or Breakthrough. The classic breakthrough operation is a frontal assault against a well-prepared defensive position, using a large amount of artillery and maneuver elements on a narrow front. The breakthrough may also occur against a hasty defense. Against each type of defense, the Threat envisions swift and deep envelopment, the bypassing of stubborn pockets of resistance, decisive meeting engagements with advancing enemy reserves, continuation of the attack, and the subsequent destruction of enemy strongpoints by second echelon units. Breakthroughs may now be accomplished in

short periods of time due to nuclear strikes and the increased lethality of conventional weapons. Successfully conducted meeting engagements and breakthroughs result in the pursuit and ultimate destruction of the enemy's forces.

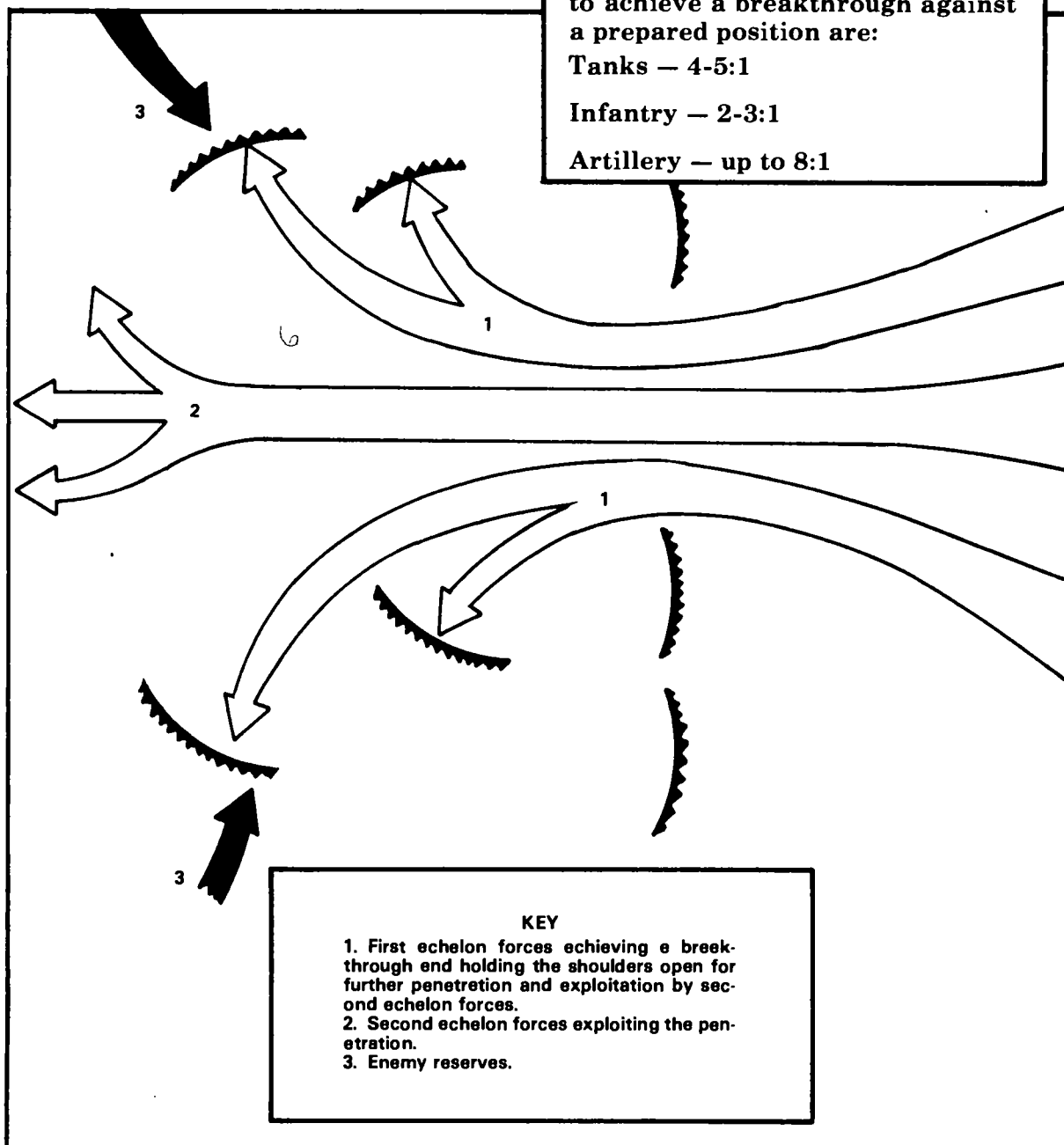
The deliberate attack is preceded by a thorough reconnaissance and enough engineer work to clear lanes through enemy obstacles. The Threat considers finding and neutralizing ATGM positions of utmost importance - one of the keys to launching a successful attack.

Threat force ratios reflected in Threat doctrine as being necessary to achieve a breakthrough against a prepared position are:

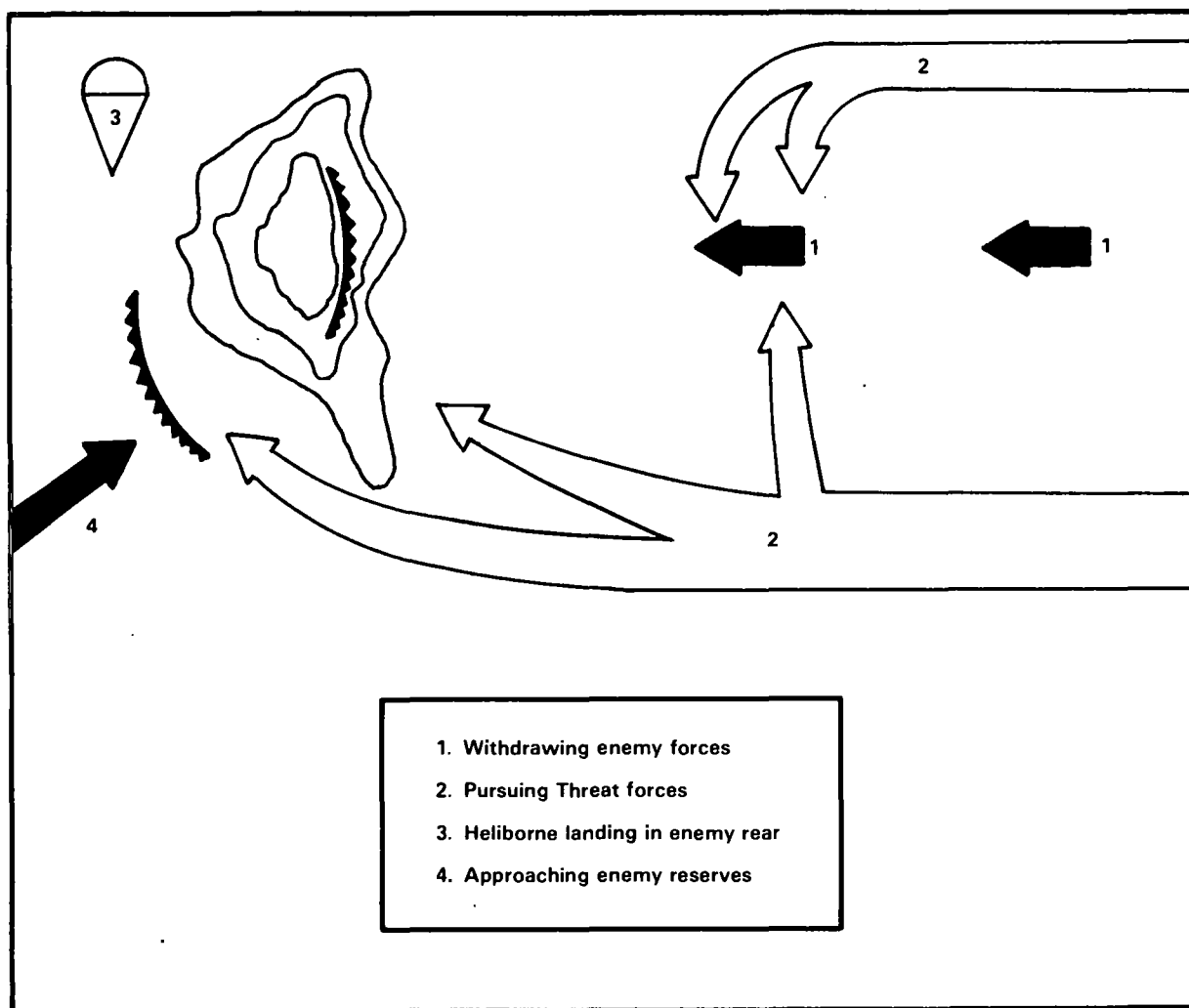
Tanks — 4-5:1

Infantry — 2-3:1

Artillery — up to 8:1



3-The Pursuit. Pursuit operations are highly mobile in nature and are best conducted on a wide front along parallel routes. They involve both frontal attacks and envelopment to cut off and destroy enemy forces. Pursuit operations are made more effective by the use of tactical heliborne and airborne forces, which occupy and defend locations in the enemy's rear and otherwise disorganize and delay his retrograde movement. The Threat stresses that the pursuit is to begin immediately upon the initiative of the commander who discovers the retreat and is terminated only on orders by army or higher commanders.



Orders to terminate the pursuit are issued when the enemy has been completely destroyed; when pursuit forces have outdistanced their logistical support or are overextended and in danger of being cut off; or, when the enemy has succeeded in establishing a strong defensive position.

THREAT ENGINEER SUPPORT

Threat offensive operations are characterized by speed and shock, much of which is aided by engineer operations.

Engineer support is well forward and priority is given to the reduction of obstacles for maneuver units and flank security against armor threats. Secondary emphasis is given engineer support in the rear areas. Engineer support is always tailored to the needs of the mission.

Engineers support by reducing obstacles, clearing passages through minefields and contaminated areas, repairing and strengthening bridges and roads, and marking march routes. Engineers provide technical assistance in reconnoitering roads, defiles, bridges, river crossing sites, bivouac areas, water supply sources, and on camouflage.

Mobility. Threat units have extensive capabilities to cross obstacles and barriers. Intensive efforts are made to locate obstacles by air or ground reconnaissance and to bypass them if possible. Any deliberate breaching operation will be accompanied by elaborate planning and will have its own fire and deception plan.

Route Clearance. Route opening detachments (ROD) are formed from the regimental or division engineer units to insure rapid rates of advance. RODs may be of platoon size and may include the following equipment: tracked dozers, crane shovels, wheeled dozers, armored tractors, vehicle mounted short-gap bridging equipment, vehicle-mounted mine detectors, dozer blades and mine plows, explosives, bangalore torpedoes, and marking devices. RODs can fill craters, clear mines, prepare short bypasses and identify contaminated areas. RODs usually move up to two hours ahead of the main body. A regimental ROD may consist of a platoon with one or two dozers and up to three tanks fitted with dozer blades. The platoon will be protected by a platoon of infantry or tanks. In movement to contact, RODs proceed behind the advance guard preparing the way for the main body; in battle, RODs move behind the first echelon, preparing routes for the second echelon.

Breaching Minefields. If the minefield cannot be bypassed it will be breached by plows or rollers mounted on tanks (1 plow/plt, 1 roller/company), rocket-propelled line charges, or bangalore torpedoes.

Passages of enemy minefields in front of the forward edge of defense are made during the period of preparatory fire. The number of passages usually is based on the number of platoons attacking in the first line. If tanks are attacking together with infantry, then one passage is made for a tank platoon and the motorized rifle platoon attacking together with it.

River Crossing. Central Europe is laced with numerous estuaries, rivers, and streams. Accordingly, Threat engineers and other ground forces are equipped, organized, and trained to cross water obstacles rapidly and do not regard crossing a water barrier as a separate phase of the battle. All crossings can be accomplished in *darkness or daylight* (dusk and dawn are favored). Constant training, and equipment designed for the purpose, facilitate water crossing operations. Motorized riflemen cross rivers in amphibious APCs. In a river crossing, tanks generally follow APCs. With the addition of snorkels most Threat tanks can deepwade up to depths of 18 feet.

Principles of crossing operations:

Initial dispersion to avoid nuclear fire.
Aggressive reconnaissance to select crossings.
Early planning and thorough organization.
Nuclear or heavy conventional fire support.
Speed and surprise.
Crossing on a broad front.
Swift development of the attack on the far bank.
Use of organic engineer amphibious equipment, and bridging and rafting at multiple sites.
Counterbattery fire and air defense.

The Threat recognizes two types of river crossing operations, hasty and deliberate.

Hasty crossing. Every attempt will be made to cross a water obstacle and secure crossing means intact by crossing with the withdrawing force or by pursuing them so closely as to prevent effective demolitions. A helicopter assault may be carried out to seize crossings in advance of the leading troops. Forward detachments will often be detailed for this task. Reconnaissance and march security elements will attempt to cross immediately on reaching the obstacle. The Threat prefers to carry out hasty crossings at night or in first light.

Deliberate crossing. A deliberate crossing is carried out if a hasty crossing has failed or if a large, well-defended water obstacle has to be crossed. These are large-scale operations, requiring detailed knowledge of the currents, crossing depths, and characteristics of the banks and riverbed, as well as the enemy defense.

Countermobility. Threat engineers perform two types of countermobility missions in offensive operations. The first is to form mobile obstacles detachments (MOD) from organic engineers to provide flank security against armored threats. These detachments vary in strength from a platoon to a company and are composed of motorized rifle squads or platoons, antitank teams, and mechanized mine layers. Their mission is to provide protection for the advancing column by laying hasty minefields and establishing other expedient obstacles along armor approaches.

The second countermobility task is to block, when possible, the withdrawal routes of bypassed units with mines and demolitions, particularly in the pursuit.

THREAT VULNERABILITIES.

In spite of having a well-trained, well-equipped, highly motivated force, the Threat's doctrine, equipment, and tactics contain "soft" areas that can and must be exploited by our defending forces.

The Threat favors the hasty attack, which leads to commitment without adequate

reconnaissance of the terrain and our defending force disposition. Troops will dismount from APCs when faced with strong defenses. The APCs drop behind the dismounted infantry to provide supporting fire. In these instances, the tanks have a tendency to maintain their forward speed, thus causing a separation between tanks and infantry and increasing the vulnerability of both to direct and indirect fire.

The thin armor protection on self-propelled artillery pieces and air defense vehicles makes them more vulnerable to penetration by direct and indirect fire. The Threat places great reliance on these weapon systems in combat operations.

The type and density of Threat equipment and its peculiarities can be used to our advantage.

Both will aid in determining the type obstacles to reinforce the terrain and how many should be placed astride the Threat's axis of advance. Knowledge of equipment limitation will also help in identifying natural obstacles. Some examples of equipment limitations that can be taken advantage of are:

- Maximum ditch crossing ability of vehicles.
- Maximum vertical obstacles climbing ability of vehicles.
- During snorkeling operations, snorkels are vulnerable to floating objects in the river and to artillery fire. Threat crossing sites must be carefully selected to insure a solid bottom, banks no steeper than 25 degrees, depth not greater than 5.5 m and a current not to exceed 3 meters per second.
- Limited far shore clearance of AVLBs. Building up the lip of a crater would add to the time the Threat needs to cross the crater. Also, placing several craters in a row will cause the Threat to use all AVLBs at one time and increase delay time.

The time, manpower, and material needed for obstacle construction must always be considered.

Section III

THE CONDUCT OF THE ACTIVE DEFENSE

In order to contribute to the defense, the engineer must properly understand how the battle will be fought by battalion task forces.

The commander plans the use of his weapon systems to achieve the required type and density of fires in accordance with his concept of how the battle will be fought. The commander organizes forces, creates or improves obstacles, plans and improves positions, and issues orders so that the battalion task force can achieve maximum effectiveness from each system in each of several potential engagements.

ORGANIZATION OF THE DEFENSE

At division and corps level, the battlefield normally is organized into three areas:

- 1- Covering force area
- 2- Main battle area
- 3- Rear area

1- Covering Force Area (CFA). The covering force has four basic tasks:

1- *Force* the enemy into revealing the strength, location and general direction of his main attack. To do this, it will be necessary to strip away enemy reconnaissance and advance guard elements. Contact with the enemy main body is sought; a fight is started with enough intensity to force the enemy to deploy maneuver and fire support units and begin his main attack.

2- *Deceive* the enemy, or prevent the enemy from determining the strength, dispositions, and locations of friendly forces, especially those in the main battle area.

3- *Divest* the enemy of his air defense umbrella, or require him to displace his air defense before attacking the main battle area.

4- *Gain time* for the main body, enabling it to deploy, move, or prepare defenses within the main battle area.

The CFA begins at the line of contact and ends at the FEBA. The size and composition of the covering force are based on the

mission, enemy, and terrain. It is normally an antitank heavy force.

The commander assigning a mission to a covering force normally will tell the covering force to fight in a specified area for a specified period of time. For example, the covering force commander might be told to operate in the covering force area for 72 hours. The covering force must find ways not only to deceive the enemy as to main battle area dispositions but also to trade space for time — time for the main battle area force to get set to defend. Therefore, the covering force mission may be a delay which could be terrain-specific, time-specific, or both.

2- Main Battle Area (MBA). The decisive battle is fought in the main battle area. Here forces will be concentrated against the enemy main thrust(s). As a result of concentration, forces usually will be unequally distributed laterally. Thus there will be differences in the way forces will fight the defensive battle, depending upon whether they are located in concentrated or lightly held areas.

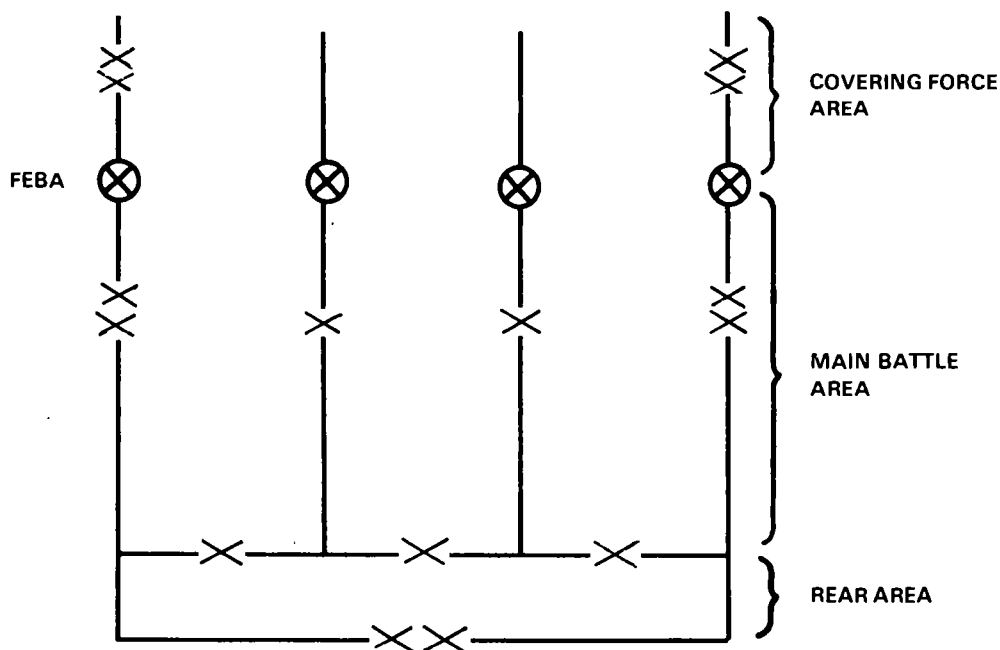
3- Rear Area. Behind the main battle area, there is an area from which supply and maintenance support must be projected forward. Here too are administrative echelons and communications centers. This area must be defended from attack as loss of any facility located in the rear area would be

a serious disadvantage to the defense. However, large forces cannot be reserved for these purposes and thus support elements must be trained and prepared for self-defense, including defense against armored forces. All rear echelon elements must use every possible measure of defense against detection from the air. Where possible, they should be hidden primarily in cities, towns, and villages.

BATTALION TASK FORCE MISSIONS

In the active defense, maneuver task forces typically will be assigned one of the following missions:

Defend in Sector. This is a relatively nonrestrictive defensive mission for brigades and battalion task forces. Sectors, used primarily in the forward portion of the MBA, are oriented on enemy avenues of approach. They are usually deeper than they are wide. This permits the defending unit to fight the battle in depth from successive positions. A commander receiving this mission generally establishes the initial positions as far forward as possible. He may use any techniques appropriate to the situation, and the full depth of his sector to destroy, stop, or drive out enemy forces. The commander must prevent enemy forces from passing through his sector beyond its rear boundary.



Defend from a Battle Area. This is the least restrictive defensive mission. As battalion task forces are concentrated in the area of maximum enemy effort, such as a breakthrough attempt, they may be assigned battle areas behind the forward task forces in the MBA. From these they can reinforce the forward task forces, or take up the battle as the enemy advances beyond the forward task force positions. A commander receiving this mission may use techniques appropriate to the situation to destroy, stop, or cause the withdrawal of enemy forces. The task force may maneuver and employ indirect fires freely within the assigned battle area. It may employ direct fires within or outside of its assigned battle area against clearly identified enemy targets. In areas of a high density of friendly task forces concentrated against enemy breakthrough efforts, it is normal for the brigade commander to reserve the authority for employment of scatterable mines.

Defend in Sector (or Defend from a Battle Area), Retain Specified Terrain. These partially restrictive missions are common in the MBA. In addition to the freedom of action and restrictions described above, the task force commander must also retain specified terrain, e.g., "retain village of NEUDORF," "retain Hill 596," or "hold Hill 597 until TF 9-72 has withdrawn south of HWY 95." The brigade commander will specify terrain to be retained when such has been directed by the division commander, where the terrain is critical to the defense, or to insure that the defensive battle conducted by adjacent units is integrated. Occasionally, an entire task force (TF) may be required to occupy and hold specified terrain features (such as a hill or town).

Delay in Sector. This is a LOW RISK mission, which requires the battalion task force to slow and defeat as much of the enemy as possible without sacrificing the tactical integrity of the battalion. This mission is also appropriate to battalion task forces in the CFA when the preservation of the TF for tasks in the MBA is more important than giving maximum delay. Such may be the case when the forces in the MBA are properly deployed in adequately prepared positions.

This mission is also appropriate as an economy-of-force operation in the MBA. Such is the case, where it is important to retain friendly forces between the enemy and his objective than to engage in higher risk defensive operations. It lessens the threat of deep penetration by enemy attacks.

Delay Forward of a Specified Line for a Specified Time. This is a HIGH RISK mission which requires the battalion task force to prevent enemy forces from reaching the specified area earlier than the specified time regardless of the cost. This mission can be given to battalion task forces in the CFA, or in the MBA if *not* in the area of concentration.

CONCENTRATING FORCES

The outnumbered defender **MUST** have the **MOBILITY** to **CONCENTRATE** the required **COMBAT POWER** at the time and place needed. Without this capability the defender cannot defeat a strong mobile enemy.

Within the task force sector or battle area the task force commander must **FOCUS ON CONCENTRATING** enough of the right type of weapon systems and fires **WHERE NEEDED AT THE RIGHT TIME** to defeat the enemy.

COUNTERATTACK

Offensive action is necessary to gain the initiative, maintain the continuity of the defense, and reposition forces to defeat following enemy echelons. A battalion task force must be prepared to counterattack whenever the opportunity for success is great. Some counterattacks are planned in great detail. Others like hasty attacks, are planned and executed rapidly. Counter-attacking forces must complete their tasks and regain covered positions before overwatching or following enemy echelons can interfere.

Counterattacks are used to destroy weakened enemy units. When counter-attacking, units maneuver only to the extent necessary to place effective fire on the enemy. Most often, this will only require movement

Section IV ENGINEERING SYSTEM IN THE DEFENSE

This section contains a description of the support provided for:

- **MOBILITY**
- **COUNTERMOBILITY**
- **GENERAL ENGINEERING**
- **FIGHTING AS INFANTRY**
- **COMMAND AND CONTROL**

from one battle position to another, using covered routes. Counterattacking forces close with the weakened enemy force only when absolutely necessary to eject it.

As a member of the combined arms team, ENGINEERS employ the ENGINEER SYSTEM in the defense to assist defending forces in winning. THE SYSTEM:

Is under the direction of the division engineer.

Provides for priority of engineer effort to the forces in contact and wherever the expertise of engineers is required.

Reinforces the terrain to enhance friendly mobility, to decrease the mobility of opposing forces and to increase the survivability of friendly forces.

Provides for general engineering as required on a priority basis.

The tactical commander will establish priorities as required. He establishes priorities, with the recommendations of his staff engineer, as required by material, manpower, or time shortage.

In the past, engineers have been used on tasks which other members of the combined arms team can perform. In the active defense, this should not be allowed, especially when the amount of essential engineer work is compared to the number of engineers available.

MOBILITY

In the ACTIVE DEFENSE, providing for the *mobility* of defending forces receives increased emphasis. Emphasis must be placed on reducing the effects of existing or reinforcing obstacles to improve the maneuver ability of tactical units and to allow for the increased forward movement of essential material. Effort goes to:

Maintenance and construction of combat roads and trails.

Bypassing or breaching obstacles.

Maintenance and construction of combat roads and trails. Covered and concealed routes are identified early to facilitate both *lateral* and *forward* movement of US Forces. Engineers must get involved in the early planning and advise the tactical commander as to which routes should be used. If at all possible, the emphasis will be on maintaining existing routes rather than constructing new ones. Although not an engineer function, traffic control measures should be planned and implemented. If possible, the tactical commander together with the supporting engineers should reconnoiter the routes allocated for movement prior to execution.

Covered and concealed combat roads and trails may have to be constructed or improvised. Selective cutting in forests can provide an umbrella over the routes which tank and mechanized forces can travel without being seen from the ground or air. Camouflaging these routes is also effective in denying enemy observation. Time and the amount of effort to be expended will be prime considerations in determining the degree to which this task is accomplished.

The engineers normally will be equipped with CEVs and AVLBS to open combat roads and trails. These will assist commanders to maneuver freely.

Likely tasks to be encountered are:

Spanning of craters or streams.

Prepositioning of bridging equipment and materials required to fill in craters created by opposing forces will save time in repair of essential routes. Speed is essential to assure timely movement of material to sustain combat operations in forward areas.

Reinforcing the terrain by strengthening existing bridges or roads. Expedient engineering methods will be required in that time and enemy activity will preclude elaborate and detailed structural reinforcement.

Early planning and identification of trails, roads or areas for lateral movement will be absolutely necessary for a successful operation.

The need for hasty road construction and tactical bridging will be extensive and these tasks must be accomplished in the minimum possible time.

Only enough work to allow the maneuver force to get through will be done. That is all that time will allow.

Bypassing or breaching obstacles. The fluid, modern battlefield will see engineers breaching or bypassing obstacles. As situations and boundaries change, engineers may have to open routes that were closed earlier. During counterattacks, both the enemy's and our obstacles will have to be breached. If a unit becomes surrounded or cut off, it will have to break through the obstacles placed by the enemy.

Additionally, engineers may have to breach minefields placed to our rear by artillery or aircraft.

***ENGINEERS ARE THE
PLANNERS OF AND
PRINCIPAL DOERS
OF OBSTACLES***

COUNTERMOBILITY

In the defense, a substantial engineer effort will be devoted to impeding the enemy by reinforcing the terrain through the use of obstacles.

The utilization of both existing and reinforcing obstacles will be imperative to the success of the defense.

Engineer assets and time will be limited. Therefore, existing obstacles will be relied upon heavily, and all reinforcing obstacles must be created rapidly and sited to *reinforce the terrain* in favor of friendly forces.

Obstacles must be carefully coordinated, however, because of the necessity for freedom of movement of the maneuvering forces.

Infantry and armor units can be expected to participate on a *very limited* scale for close-in protection.

Engineers at all levels in the division have a responsibility for obstacle planning.

Coordination. Obstacle systems are part of the defense plan. The brigade and battalion task force engineers must be deeply involved in every stage of planning and development. Well-planned obstacles will serve as a combat *multiplier*, increasing the probability of a hit on a target, canalizing the enemy or denying the use of specific terrain.

Specific responsibilities of the *brigade engineer* are:

Planning and supervising all engineer activities pertaining to obstacles within the brigade area of responsibility.

Assisting the brigade intelligence officer by developing terrain analysis and reconnaissance information and by evaluating bridges, tunnels, roads, and dams as possible demolition targets.

Preparing the brigade obstacle plan.

Providing the brigade logistics officer with an estimate for all obstacle materials.

Supervising the technical aspects of engineer troop employment and recommending to the brigade operations officer the allocation of engineer resources.

Locating and determining the effectiveness of existing natural and cultural obstacles from actual reconnaissance or study of maps and aerial photographs.

The engineer platoon leader supporting a battalion task force must perform the same functions.

Selection and siting. Ideally, an extensive system of obstacles will be created to support the defense. Normally, time and resources will not permit such a system to be built; however, the system will be developed to the extent possible.

Engineers must work closely with the commander to insure maximum effectiveness of obstacles. Therefore, considerable thought must be given to the terrain, tactical situation, logistic support, time, and manpower available.

The primary purpose of obstacle employment is to enhance the effectiveness of friendly antitank fires.

Guidelines to establish the overall effectiveness of an obstacle are difficult to determine. However, the selection of a particular type obstacle and the siting of that obstacle are of the utmost importance to the success of the obstacle system.

When selecting and siting reinforcing obstacles, the following principles must be adhered to:

Employment in conjunction with existing and other reinforcing obstacles. Obstacles must be sited to take full advantage of existing or other reinforcing obstacles to keep logistic and construction requirements to a minimum. Natural obstacles must be improved and exploited to the fullest extent possible. Reinforcing obstacles are sited to tie together, strengthen, and extend existing obstacles. Effective reinforcement of existing obstacles also permits friendly forces to concentrate on more trafficable terrain approaches. It is fundamental that an obstacle system should be as difficult to breach as to bypass, except when the obstacle is intended to divert or deflect the enemy rather than to delay or stop him.

Employment in depth. Obstacles do not seriously hamper the enemy's movement until they overload or heavily tax his breaching capabilities. This cannot be done unless obstacles are employed in depth. It is prohibitive in time and resources to build large continuous obstacles. Building successive obstacles, one behind the other, is more effective because it requires the enemy force to continually deploy and regroup thus slowing and dividing its efforts. Obstacles should be located along and astride avenues of approach at frequent intervals, every 200 to 500 meters. Obstacles must be far enough apart that each one will require a new deployment of the enemy's breaching equipment.

Variety of obstacles. A variety of reinforcing obstacles should be used, when practicable, to increase effectiveness and to aid in surprise and deception.

Camouflage and concealment.

Camouflage. Obstacles should be camouflaged or employed in such a way that they come as a surprise to the enemy. When the enemy has no prior knowledge of an obstacle, he has to reduce it without benefit of prior planning. If the obstacle is defended, the defender has the advantage of the enemy's first reaction, which is usually confusion, and the enemy may be caught without the men and material to breach the obstacle.

Proper siting is often the easiest solution to obstacle camouflage problems. Large obstacle systems cannot be concealed by siting alone. They can be made inconspicuous from enemy ground observation by taking proper advantage of the terrain in locating them. Obstacles should be located in folds of the ground, around blind curves in roads, or just over the top of hills. To help camouflage obstacles from aerial observation, regular geometric layouts of obstacles should be avoided.

Concealment. The best way to conceal an obstacle usually is to postpone its execution or construction as long as possible without interfering with its readiness when needed. Obstacles created by demolitions lend themselves readily to this procedure. When their use is contemplated, they should be executed as late as possible.

Integration with observed fires. The principal reason for integrating obstacle locations with fires is to enhance the effectiveness of those fires. Considering terrain and the effective ranges of available weapons the tactical commander and his engineer site weapons and obstacles to offer the best possible advantage. Special attention must be given to locating obstacles to complement the fires of TOWs, tanks, and Dragons. Observation and adjustment of fires are essential if the full advantage is to be developed.

Integration with the scheme of maneuver. This principle is twofold; it refers to both friendly and enemy movement. Mutually supporting obstacles are sited to direct, lead or lure the enemy along previously selected avenues of approach. The

second part of this principle is that obstacles must allow for the friendly scheme of maneuver, the orientation of the obstacle designed to impede the enemy cannot seriously hinder friendly movement.

Provision for lanes and gaps. Concealed lanes or gaps through the system are left whenever obstacles are employed around a battle position or area. These lanes are provided so that patrols, counterattacks, and friendly troops on other missions may move through the system without difficulty. Plans must exist to insure that all lanes or gaps can be blocked quickly when enemy action is expected. Lanes and gaps should be covered by fire to preclude the possibility of the enemy rushing through them before they can be closed.

Target acquisition. Obstacles in the battalion task force area should be sited to increase the time the enemy will be in the weapon's target window. Obstacles should be placed 100 to 200 meters short of the effective range of the weapon being complemented. This will insure that the enemy gets within the weapon's target window.

It is the engineer's job at each level to insure that obstacle plans consider constraints on time and resources.

Existing obstacles. Usually, time, labor, and materials can be saved by improving existing obstacles rather than constructing reinforcing ones to serve the same purpose. Desirable characteristics of an existing obstacle are:

Supports the defensive plan.
Easy to convert into a more effective obstacle with a minimum of effort, materials, and time.
In defilade from enemy observation
Located where observed defensive fire can kill the enemy in breaching attempts.
Difficult to bypass.

The most effective existing obstacles against tanks are steep slopes, unfrozen swamps, and broad, deep streams.

Steep Slopes. Varying degrees of steepness are required to stop different types of vehicles. Tanks can negotiate slopes as steep as 60 percent under ideal conditions, 45 percent as a practical limit. However, trees, unfavorable soil conditions, large rocks, and boulders can make slopes of less than 45 percent impassable, even though this would not be true if the same natural features were encountered on level ground. The movement of infantry is also slowed down by steep slopes since movement is slower and the troops tire more rapidly.

Escarments. A steep face of rock or earth is a formidable obstacle to both vehicles and personnel if it is over 1.2 meters (4 ft) in height.

Ravines, Gullies and Ditches. Ravines, gullies, and ditches generally are obstacles to wheeled vehicles, if they are over 3 meters (10 ft) in width, approximately 1.2 meters (4 ft) in depth and the banks are nearly vertical.

Rivers, Streams, and Canals. The major obstacle value of rivers, streams, and canals is that they must be crossed by special means, either deepwater fording, surface, or aerial. The width, depth, and velocity of the water and bank and bottom conditions determine the ease of crossing a water obstacle by deepwater fording and floating equipment.

The obstacle value of fordable rivers, streams and canals is significant when the stability of the banks and bottom is considered. Although a few vehicles may be able to ford a water obstacle, the poor condition of the banks and bottom may prevent further use of the ford without time consuming improvement of the crossing site. Stream velocity may likewise limit the use of a ford and enhance its value as an obstacle.

Frozen Streams. Antitank obstacles can be improvised in frozen streams by cutting an opening about 3 meters (10 ft) wide in the ice and forcing the cut blocks of ice under the solid surface so that the blocks will be carried downstream by the current. The openings are then closed with a light frame covered with a 10 cm (4 in) covering of snow. The effectiveness of this type of obstacle depends on keeping the water in the channel from freezing.

Lakes. Lakes are usually unfordable and unbridged. They must be bypassed unless frozen solid enough to support vehicles and personnel.

Swamps and Marshes. The principal obstacle value of swamps and marshes is the canalization of vehicular movement onto causeways. Swamps and marshes over 1 meter (3.3 ft) in depth may be better obstacles than rivers, since causeways are usually more difficult to construct than bridges. The physical effort required for foot troops to cross swamps and marshes is an important factor in their usefulness as an obstacle. All roads and causeways through swamps and marshes should be extensively cratered, mined, or blocked by abatis.

Forests. Forests have the effect of canalizing movement, since the roads, trails, and firebreaks through them provide the only means for rapid movement. The obstacle value of a forest is dependent on tree size and density, soil condition, slope, and depth. If the trees are at least 20 cm (8 in) in diameter and sufficiently close together, they will seriously obstruct or stop the movement of tanks. Even though the trees are seldom close enough together to stop tanks, they may prevent tank movement when they are pushed over and tangled. Much smaller trees (10 cm (4 in) in diameter) will slow and sometimes stop tanks on 20 percent slopes. Tree stumps that are 45 cm (18 in) in diameter or larger are obstacles to tank movement. Forest undergrowth in the temperate zone usually is not dense enough to seriously obstruct foot movement, but such movement will be slowed significantly by steep slopes, adverse soil conditions, and fallen trees and branches. The most effective way of increasing the obstacle value of forests is to:

Construct abatis or craters.

Place mines along the roads, trails, and firebreaks.

Construct log cribs, hurdles, and post obstacles if the necessary materials are available.

Snow. Snow is considered deep for purpose of foot or vehicle movement when the average depth above ground elevation is 1 meter (3.3 ft). Deep snow and the accompanying ice and intense cold combine to create obstacles of major significance. Deep snow is an obstacle to movement of both foot troops and vehicles. It also blankets terrain features such as boulders, rocky areas, ditches, small streams, and fallen trees so as to effectively impede movement. The obstacle value of snow can be increased by —

Erecting snow fences or breaks so that the prevailing winds will accelerate the accumulation of snow into drifts to form snow obstacles of packed snow.

Building snow walls as obstacles against armor. The snow must be packed hard for this purpose. Walls of this type are most effective when they are sited on an upgrade.

Cultural Features. Cultural features are the work of man. Examples are stone walls, hedgerows, dikes, canals, drainage ditches, embankments, cuts, fills, and built-up areas. Cultural features cannot be overlooked in evaluating terrain for obstacles. The obstacle value of a cultural feature depends on its size or extent, location, and construction.

The existing obstacle value of built-up areas can be readily reinforced by cratering streets, overturning or derailling street or railroad cars, and constructing roadblocks from rubble. Cities and towns become obstacles of considerable importance because they restrict enemy movement. Even if gaps are cleared movement is still canalized.

Another extremely important cultural feature is the road and railroad net. It has a fundamental influence on the enemy's choice of objectives and approaches. The enemy's anticipated rate of advance forces him to rely on the existing net for logistics support, movement of the second echelon and all but the lead elements of his main body move by road unless forced to deploy.

Minor cultural features also can act as obstacles. A stone wall or hedgerow is a

serious obstacle, unless the vehicle can push through it or go over it. Gravel pits, quarries, or areas where strip mining has taken place may be obstacles for vehicles and they must be evaluated, particularly for slope and soil characteristics.

Use existing obstacles whenever possible.

Reinforcing Obstacles. Reinforcing obstacles are those specially constructed, emplaced, or detonated to serve the purposes of an anticipated military action or one that already is in progress. Reinforcing obstacles normally are used to close gaps and block or destroy lanes in existing obstacles, or to strengthen weaker areas. In some cases they are used to extend obstacles or to create obstacles in open country. The nature and extent of reinforcing obstacles is limited only by imagination and ingenuity.

Minefields. Minefields are an extremely important type of obstacle that will be used extensively on the next battlefield for the following reasons:

1 Most obstacles impede the enemy because of their physical characteristics. Minefields are unique because they can kill personnel and immobilize or destroy vehicles. The installation of minefields changes favorable terrain to unfavorable terrain for the offense system and materially enhances the strength of the defense system.

2 Even though the use of mine rollers and plows decreases the effectiveness of the minefield to kill tanks, the minefield is still an effective obstacle. When using plows and rollers, speed is reduced and vehicles without countermine equipment will follow those with the equipment. This means their vehicles are canalized and slowed, hence easier targets for our antitank weapons.

3 Placing mines on the surface is almost as effective as burying them because mines are difficult to spot from a moving, buttoned-up armored vehicle. If spotted, the enemy must slow, either to try to avoid the mines or to begin using plows and rollers. In either case it is easier for our antitank weapons to kill the enemy.

The first of the family of scatterable mines (FASCAM) systems is now in the field in Europe. The system is the M56 helicopter delivered scatterable mine system. The system consists of a dispenser, containing 80 antitank/antivehicular mines, that can be mounted on both sides of a UH-1H helicopter. One helicopter carrying two dispensers (160 mines) can create a minefield 20 meters wide and from 100 to 300 meters long. The M56 system can rapidly emplace a minefield, enlarge an existing minefield, and reach areas not readily accessible by ground transportation.

The M-56 mine has a pressure type fuze that is effective against both tracked and wheeled vehicles. A certain percentage of the mines are equipped with an antihandling device to hinder manual breaching. All the mines are equipped with a self destruct time— after a set period of time the mines blow themselves up.

The most significant constraint on employment of the M56 system is the vulnerability of the helicopter. Against any enemy with significant air defense ability, employment will either be limited to secure areas or require suppression of the Threat in the area to be mined.

Information on the other FASCAM systems is contained in chapter 6 and appendix L.

Types of Minefields. There are five types of minefields:

1- *Protective*

2- *Point*

3- *Tactical*

4- *Interdiction*

5- *Phony*

1- *Protective minefields.* There are two types of protective minefields - hasty and deliberate.

Deliberate minefields are used for static installation protection as part of the perimeter defense.

Hasty minefields are used for close-in

defense and are covered by observation and fire. The unit that lays the minefield is responsible for picking it up or transferring it to another unit when the laying unit gets ready to move out. No boobytraps or antihandling devices are used and only metallic mines are used to insure ease of removal.

2- *Point minefields.* Point minefields normally are irregular in size and may contain the full range of available mines and antihandling devices. This type of minefield can be used for mining the following:

A road crater or other obstacles.
Likely avenues of approach to develop targets for AT weapons.
Routes (during a delay).
Streams and fords.
Likely LZs and DZs.

3- *Tactical minefields.* Tactical minefields are different from the first two types in that they are most often laid to a standard pattern and have a specific density of mines by type. In addition to laying mines by hand tactical minefields may also be laid using the M57 mine dispensing system, which gives a row pattern. This type of minefield normally is planned at division and/or brigade level and fits into the overall tactical plan of that headquarters.

Tactical minefields are used to—

Stop, delay, or disrupt an enemy attack.
Assist in the reduction of enemy mobility.
Assist in blocking penetrations.
Strengthen manned positions.
Protect friendly flanks.

MINEFIELD EMPLOYMENT AUTHORITY		
Type	Authority to employ	Authority may be delegated to
Hasty Protective	Battalion Commander	Company Commander, Platoon leader
Deliberate Protective	Installation Commander	
Point	Division Commander	Brigade Commander
Tactical	Division Commander	Brigade Commander
Interdiction	Corps Commander	Division Commander
Phony	Same as minefield being simulated	

4- Interdiction minefields. Interdiction minefields are employed by corps or divisions beyond the range of organic division weapons to entrap the enemy or cause harassment behind enemy lines.

5- Phony minefields. Phony minefields are used when lack of time, personnel, or materials prevents laying a live minefield; to deceive the enemy into thinking an area is mined; to extend or supplement live minefields (camouflage gaps).

Minefield Employment. The types of minefields most frequently employed in the brigade area will be hasty protective, point, and tactical.

Hasty protective minefields will be employed by maneuver units around their battle positions.

Small point minefields will be emplaced by engineer platoons for maneuver battalions. The point minefield can be used to increase the effectiveness of other obstacles (craters, log cribs, stream banks, etc.) or as a separate obstacle, to slow enemy armor, thus affording antiarmor weapons a better target.

Tactical minefields will be emplaced by brigade engineers using the M57 antitank mine dispensing system or the M56 helicopter delivered scatterable mine system. (Both systems are located only in European units.)

The most effective means today and in the foreseeable future of achieving countermobility is through the use of mines. The authority to employ is dependent upon time, type and purpose of the minefield.

Demolition obstacles. These obstacles are created by the detonation of explosives, including nuclear explosives. Demolition obstacles include structures, like bridges, and the moving of earth and rock. Demolitions are also used in denial operations to destroy facilities or materials.

The following types of demolitions can be used to create obstacles—

Reserved Demolitions. These are specifically controlled at a command level (brigade, division, or corps) appropriate to

the tactical or strategic plan. Reserved demolitions usually are placed by engineers in the safe condition (charges in place waiting to be armed). To insure proper execution a target folder should be prepared. Personnel must be left at the target to guard and execute the target when ordered.

Tactical units should guard and actually execute or fire most reserved demolitions within their defensive sector. The engineer's capabilities should not be depleted by obstacle guarding and firing responsibilities at every obstacle location.

An engineer firing party will remain with certain key targets as designated by the authorized commander. Such targets include (1) those important enough that the enemy may attempt to seize them in advance of his forces, or (2) those likely to be exposed to enemy fire before detonation, thus possibly requiring repair or replacement of certain demolitions or firing circuits.

Reserve demolitions will be designated by corps, division, and brigade, and normally will be located astride high speed avenues of approach.

Deliberate Demolitions. Deliberate demolitions are used when enemy interference during preparations is unlikely and there is sufficient time for thorough reconnaissance and careful preparation. Deliberate preparation permits economy in the use of explosives, since time permits accurate calculation of explosives needed and positive charge placement to obtain the effects required.

Hasty Demolitions. Hasty demolitions are used when time is limited and economy of explosives is secondary to speed. In all cases, common sense and good judgement must be exercised to prevent waste. In the preparation of demolition projects in forward areas where surprise by enemy forces is possible, a priority should be given to each charge. Although this procedure is relatively time consuming, it causes maximum damage in relation to the time required, even though enemy interference might prevent completion of the job. Each charge is primed as it is placed; for if charges are all placed first and then primed, it is possible that

enemy interference could prevent even partial destruction of the target. The use of dual detonating cord ring main lines and branch lines are recommended for all frontline demolition projects.

Atomic demolition munitions (ADM). ADMs use nuclear energy to provide the explosive energy equivalent to hundreds of thousands of tons of TNT in a small portable package. Since ADMs produce side effects (blast, thermal, radiation) that extend to significant distances and may or may not be desirable, safety of nearby troops or any civilians becomes a major consideration in the use of ADMs.

Success of tactical plans must not rely on the use of ADMs, because they are subject to certain political restrictions and may not always be available for use. Because of the uncertainty of ADM release, use of nonnuclear demolitions must be planned for all desired targets.

Once ADMs are authorized, responsibility normally is decentralized to the lowest tactical echelon capable of conducting ADM mission planning, coordination, and execution. The employment and execution of ADMs will be accomplished by platoons from the corps ADM company. However, the division engineer battalion must be prepared to plan and support the mission. ADM mission support can include preparing command sites, constructing emplacement sites, and providing security.

Demolitions in the Battalion Task Force Area. Engineers working with task forces will use demolitions to:

1 Destroy bridges.

2 Create:

- *Road craters.*
- *Antitank ditches.*
- *Abatis.*
- *Rubble (in towns and cities).*

Constructed Obstacles. Constructed obstacles include a wide variety of obstacles ranging from tanglefoot to extensive concrete and steel obstacles. Constructed obstacles fall into two broad categories: wire obstacles and antitank obstacles.

Wire obstacles. Wire entanglements are designed to impede the movement of foot troops and, in some cases, tracked and wheeled vehicles.

To be effective, barbed wire entanglements are sited and laid out to meet the following requirements:

Visible to friendly observation, covered by fire and protected by antipersonnel mines, flame mines, trip flares, and warning devices.

Concealed from enemy observation by incorporating terrain features such as reverse slopes, hedges, woods, paths and fence lines.

Erected in irregular and non-geometrical traces.

Emplaced in bands or zones.

Coordinated with other elements of the defense.

Because of the nature of the battlefield (fluid and armor-heavy) wire obstacles normally will not be used (exceptions would be for a strongpoint or terrain that must be retained). However, wire will be used to strengthen other obstacles (between log posts, in the bottom of ditches).

Around areas that will be retained, concertina fences, general purpose barbed tape obstacles (GPBTO), and tanglefoot will be used to provide protection against dismounted infantry.

Antitank obstacles. Log obstacles (hurdles, cribs, posts, and abatis), concrete and steel obstacles (tetrahedrons, hedgehogs, and falling block obstacles), and ditches are effective tank obstacles. They should be sited to take advantage of trees, brush, or folds in the ground for concealment

and surprise effect. If they can be sited to permit flooding with water, the obstacle becomes more effective and helps deny its use to the enemy as a protected firing position. Care must be taken when using these obstacles in forward areas because of the extensive preparation time involved (an exception would be an abatis created by demolitions or chain saws).

They are excellent obstacles to slow the enemy and provide antitank weapons more time to destroy a target.

Expedient Obstacles. Expedient obstacles offer an almost unlimited potential for use. The logistic burden associated with other reinforcing obstacles places a great premium on imagination and ingenuity in the use of available resources.

Some examples of expedient obstacles are:

Roadblocks made from cars and trucks which have been loaded with rocks or other heavy materials.

Pushing trees, large rocks, and other material onto a climbable slope to further slow or to stop the enemy.

Flooding areas to make the soil untrafficable to armored vehicles.

Strongpoints. On the mechanized battlefield strongpoints are antiarmor positions. A strongpoint is not routinely established, but only after the tactical commander determines that a strongpoint is necessary to prevent a decisive penetration of his defensive system by enemy armor. Strongpoints should be sited near existing obstacles, or extensive reinforcing obstacles should be placed around them to stop mounted or dismounted assaults.

The establishment of a strongpoint is a major engineer mission and requires detailed coordination between the engineer and the maneuver unit designated to occupy the position. Corps combat and combat heavy engineer units are often given the mission of supporting major strongpoint construction because of the magnitude of the task. Appendix I provides detailed guidance on planning and constructing strongpoints.

SURVIVABILITY

Survivability is:

The development of protective positions.

The application of counter-surveillance measures.

Terrain reinforcement is an integral part of survivability. It is an advantage that must be exploited by the defender for as long as time will allow. Failure to do so is measured in the number of lives and material lost during the initial artillery preparation by Threat forces.

The engineer is the key to terrain reinforcement.

The engineer element of the combined arms team contains the expertise to reinforce the terrain. This expertise is:

Knowledge of principles and techniques of survivability.

Dedicated and trained, mission-oriented soldiers to do the job.

Special tools and equipment for rapid excavation and field fortification construction.

The application of countersurveillance measures with reinforcement of terrain will enhance the individual and weapon system survivability on the modern battlefield.

Protective Positions/Battle Positions. The preparation of protective positions is such a large task that all units must take part to the extent they are able. The siting is the responsibility of the individual unit commander.

Individual soldiers provide quick, rudimentary, defilade positions. Armored vehicles will find defilade positions. Priority will be given to providing protective positions for ATGM systems. These positions become the initial building blocks for the defense.

Engineers will provide equipment and manpower to assist in the initial preparation and the construction of improved positions.

The order that the engineers work in is dependent upon many factors (terrain, equipment available, the Threat, maneuver commanders' priorities). Although some tasks will be done simultaneously, the tasks should be accomplished according to the following priority:

- 1- TOW positions.**
- 2- Tank positions.**
- 3- APC positions.**
- 4- Command bunkers.**
- 5- Crew served weapon positions.**
- 6- Individual fighting positions.**
- 7- Communication trenches.**

Dozers, CEVs, and frontloaders will initially make small modifications to the terrain in the form of ramps to allow tanks and vehicle-mounted TOWs to more effectively utilize the terrain. As time permits, these hull down and turret down positions will be improved to form hull and turret defilade positions for all tanks, vehicle-mounted TOWs, and APCs.

Backhoes and frontloaders will be used to dig positions for dismounted TOWs, command bunkers, other crew served weapon positions, and to improve individual fighting positions. In addition the backhoe can be used to dig communication trenches.

Chain saws will be used to cut lumber to provide overhead cover for bunker and fighting positions. The chain saws can also be used to help clear fields of fires.

Engineer squad and platoon handtools will be used by both the engineers and the maneuver force personnel to aid in the preparation of fighting positions.

As time allows, these positions (and alternate ones as well) are improved.

IMPROVEMENT IS CONTINUOUS

There are three intertwined factors that determine how much time engineers will spend on preparing protective positions.

1- Mission. The commander must decide whether engineers are to build obstacles,

prepare protective positions, or cut out routes between battle positions. As such, the commander's mission could be the deciding factor.

2- Permanency. The time that a unit will remain in one position, and the availability of materials or equipment will dictate how much positions are improved.

3- Time. The length of time that the unit has before it expects contact with the enemy.

Battle positions are prepared by tying the mutually supporting individual protective positions together.

Countersurveillance Measures. The defense will be characterized by elaborate and complete camouflage and deception in support of the overall countersurveillance effort. The role of the engineer is to advise and assist.

Camouflage. Although camouflage is the responsibility of the individual units, the engineer is expected to be the expert. Engineers may be called upon to assist in installing camouflage positions when the requirement for construction procedures and equipment exceeds the capabilities of the tactical unit.

During defensive operations camouflage will assist the engineer to survive. Individuals, equipment, and vehicles, as well as job site camouflage, will be the rule rather than the exception. Camouflage discipline *must be imposed and adhered to* on the modern battlefield.

Proper siting of protective positions is the easiest and most effective means to overcome the factors of recognition. The best way to evaluate for correct siting, if time and the enemy situation will allow, is to go out and look at it from the enemy's vantage point. Positions should blend into the surrounding terrain pattern. They should be hidden in buildings, in dead spaces or in the wood line in order to hide from sensors. Existing tracks or roads should be used when traveling, and the tracks should be erased when leaving the road.

Proper use of camouflage nets, screens, or natural material will also aid in surviving.

Natural camouflage or existing foliage must be properly maintained.

Probably the most important, but least emphasized, principle is discipline. Self-discipline is the most critical aspect of camouflage. Light and noise discipline especially must be enforced at night.

Deception. Deception is action taken to mislead the enemy by manipulative distortion or falsification of evidence in order to induce the enemy to react in a manner against his own interests.

Units which are able to simulate defensive positions may be able to deceive the enemy as to their true location. This will cause the enemy to waste time or material in determining just where our forces are located.

Deception devices and methods are wide and varied. Plans vary from simply placing logs on berms (to simulate antitank or TOW position) to large elaborate and complex tasks such as dummy POL tank farms, supply depots, marshalling areas, etc.

The main interest of engineers is in *visual deception*. This involves the use of equipment covers or camouflage. Covers or nets placed over a framework will give the appearance of equipment. Time and Threat surveillance techniques are primary considerations in the method or material selected to use in a deception operation.

The planning considerations are:

Predicting the enemy reactions.
Flexibility.
Cost in terms of time and material.
Secrecy.
Originality and creativity.
Realism and plausibility.
Time to react.
Continuity.

Engineers will:

Provide assistance in camouflage and concealment.

Construct and provide material for dummy positions/decoys.

Provide assistance on dummy positions and decoy construction.

Smoke. Engineers will use smoke to obscure enemy observation of work sites and withdrawal routes. Care must be taken when employing smoke not to degrade the friendly forces' effort to establish the defense or to successfully withdraw. Overuse may be detrimental to accomplishment of the mission. When employing smoke, consider:

The major terrain features within the target area.

Atmospheric stability.

Wind speed and direction.

GENERAL ENGINEERING

General engineering comprises those tasks which do not directly contribute to the mobility, countermobility, and survivability of the committed maneuver elements. This support is:

Continuous.

Primarily in brigade and division rear areas.

Under the direct control of the division engineer.

During defense operations general engineering will include:

Main supply route (MSR) construction and maintenance.

Protection construction.

Support facilities construction.

Bridging.

Water supply.

Terrain analysis and information.

ADM missions.

The division engineer battalion is staffed and equipped to fight with the committed maneuver brigades. Corps engineers provide the primary capability to accomplish general engineering missions in the division area.

MSR Construction and Maintenance. As in the offense, this task will be accomplished by combat and combat (heavy) battalions from corps. These battalions normally will concentrate their effort on routes (designated by the commander) which lead directly into the brigade areas, and over which most of the resupply effort of the division must pass. The majority of the effort will be spent on maintaining and repairing the MSR and not in construction of new MSRs.

Protective Construction. This is the construction of protective positions for brigade and division command posts and the hardening of critical supply facilities. These locations are priority targets for enemy air and rocket attacks and as such must be dug in. The corps combat engineer battalions will be responsible for the construction of these protective positions.

Support Facilities Construction and Repair. This task will be accomplished by combat heavy battalions and other specialized construction units from corps. Some of the missions in this area would be construction or repair of airfields, development of minimum essential logistic areas, installation of POL pipelines, and construction of ammo/fuel bunkers.

Bridging. In the defense, bridging would consist of reinforcing bridges, repairing damaged bridging, and replacing destroyed bridges. This task would be done by the corps bridge companies (MGB, MAB, Panel, etc.) and combat engineer battalions from corps and division.

Water Supply. Potable water for the division is supplied by the organic water purification equipment in the division engineer battalion. Normally this equipment would be located in the rear of each brigade area and in division rear. The division water purification equipment can be augmented by equipment in the corps combat engineer battalion or the corps water supply company.

Terrain Analysis and Information. Terrain analysis and information will come from all units in the division. In addition the engineer topographical battalion provides a corps terrain team and a division support element to assist in the analysis of information and to provide studies and reports beyond the capabilities of the division.

FIGHTING AS INFANTRY

The division engineer battalion, or any element thereof, engages in combat when--

- The enemy prevents access to the unit's job site.
- The enemy attempts to drive the engineer unit from a job site.
- The enemy prevents delivery of supplies.
- Enemy action forces a combat role. This may develop in several ways--

The unit commander is forced into a combat role in order to save the unit.

Enemy action forces the unit to fight so the higher command can accomplish its mission.

Because of the situation, the division commander decides to commit the engineer unit.

Fighting as infantry will be a normal part of engineer operations and the engineer must be prepared to fight while carrying out his engineer tasks.

Only as a last resort will engineers be employed to fight as infantry.

In the defense, if a battalion or company, should be employed as infantry by order of the division commander, it normally would be given one of the following missions:

Rear Area Protection. To counterattack a breakthrough or an airmobile, airborne insertion.

Economy of Force. Due to the commitment of maneuver forces an engineer unit would defend an area outside the area of concentration.

Reinforcement. Within the area of concentration an engineer battalion or company would occupy battle areas when no other units are available to reinforce the brigade.

Several factors must be considered before committing engineers as infantry.

- Engineers have no long range antitank weapons (TOW) or indirect fire support.
- The reorganization is not instantaneous. Time is needed to move personnel and equipment. An engineer battalion usually has its combat engineer companies located with each committed brigade with elements of the bridge company and the headquarters company's equipment platoon supporting these companies. The remaining "operational" elements of the battalion are committed throughout the division area in general support of the division. The combat engineer platoons are committed throughout the brigade area in support of maneuver task forces.
- Most importantly, when committed as infantry, engineers cease doing engineer tasks.

COMMAND AND CONTROL

It is imperative that the staff engineer have a thorough understanding of the command and control relationship within his area of responsibility.

The Division Engineer. The engineer battalion commander is the engineer special staff officer responsible to the division commander for *all engineer related matters* in the defense. The division engineer and his staff *coordinate all engineer related actions* to insure division defensive requirements are met. He recommends to the division commander the employment and support relationship of the engineers. His recommendations, as modified or approved by the CG, are conveyed to all tactical commanders as part of the division operations order. If the workload exceeds the

capabilities of the division engineers, then additional engineer effort is requested from corps. In the active defense a likely allocation to each committed division may be two corps combat battalions employed in the division area.

The division engineer is responsible for all engineer effort in the division area.

The division engineer:

Commands the division engineer battalion.

Coordinates or directs the total engineer effort in the division area including the effort of engineers from corps.

The Assistant Division Engineer (ADE). During the planning of the defense, the ADE will be the engineer point of contact at division. He will provide:

Timely coordination with division staff.

The engineer input to the division OPORD/OPLAN.

Assistance in planning for and preparation of obstacle annex.

The ADE, who is located at the division main command post, provides information back to the battalion commander on present and future actions at division.

The Brigade Engineer. Normally there is a division engineer company operating with each brigade. That division engineer company commander is usually the brigade engineer and controls the engineer effort in the brigade area.

If the division engineer determines that the number of engineers operating within the brigade area exceeds the coordinating capability of the brigade engineer, he may form a task force to carry out the function. In this case, the task force commander is given the mission and allocated the necessary staff (division and supporting engineers contribute) by the division engineer to act as

the brigade engineer.

This provides the brigade commander continuity and a centralized point of contact for engineer matters.

The brigade engineer directs the allocation of the engineers based on:

The brigade commander's plan.
The brigade requirements.
The assets available to him.

The brigade engineer can reallocate any engineer resources based on changes in the defensive situation.

Command and Support Relationship.

Attachment. Engineers are usually *attached* to maneuver units when time/or distance factors *prohibit* control by the parent engineer unit.

This is normally the case in the covering force area (CFA). As such, engineers operating in the area will be attached to the major tactical force in the CFA.

Direct Support. This is the normal relationship of division engineer units working within a brigade area. The engineer gives priority to and responds directly to requests from the supported unit commander.

General Support. Individual tasks are assigned by division or brigade engineers to engineer units. General support normally occurs in brigade and division rear areas. GS is support given to a force or an area as a whole and not to any particular unit.

Operational Control (OPCON). OPCON places an engineer unit under the direction of the unit they are supporting for a specific mission. While tasking comes from the supported unit, administrative and logistic support still comes from the parent unit.

Task Force. A task force is formed when there are too many engineers in one area to be controlled by a company commander. A task force headquarters may be formed by using a battalion headquarters or by detaching a number of staff personnel from an engineer battalion or by forming a staff from personnel in the companies forming the task force. Task forces are formed for a specific mission or period of time.

Engineer Reconnaissance. Engineer reconnaissance will be continuous during the defense. A large portion of the reconnaissance will have been conducted prior to a conflict. New and accurate information must be provided to maneuver units for the mobility/countermobility required in the active defense. *Engineers* need this information.

The division engineer establishes essential elements of information and tasks his intelligence officer for the detailed reconnaissance and planning. Reconnaissance that cannot be accomplished by recon teams of the battalion intelligence section is assigned to line companies or other intelligence sources. Information on route, stream, bridge, obstacle, air landing facility, and support areas are common requirements.

Section V

DEFENSE

SCENARIO

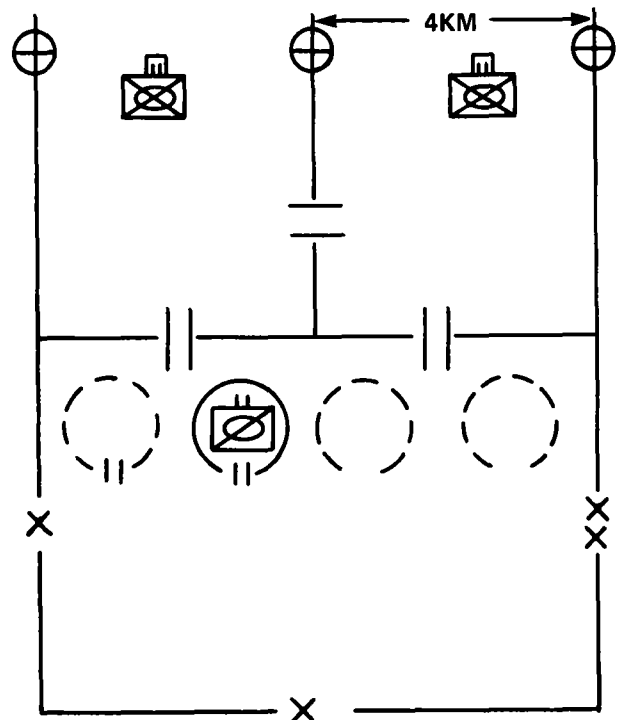
This scenario shows how an engineer platoon will work with a battalion task force in a defense-in-sector situation.

TACTICAL SITUATION

In this example, the brigade commander on the right anticipates an attack by a motorized rifle division with two motorized rifle regiments forward, each on a front of 3 to 4 kilometers. The brigade commander plans to block the advance of each regiment with a mechanized infantry battalion task force and use the cavalry squadron that the division commander gave him to block, reinforce, or counterattack as the battle develops. The armor task force normally assigned to the 2d Bde has been relocated by the division commander to the sector of the 1st Bde.

This scenario will deal with the actions taken in one of the mechanized infantry task force areas (TF2-76). This task force must stop a regiment-sized attack force. The task force commander is assigned the mission of defending in sector on the right.

"Defense in Sector"

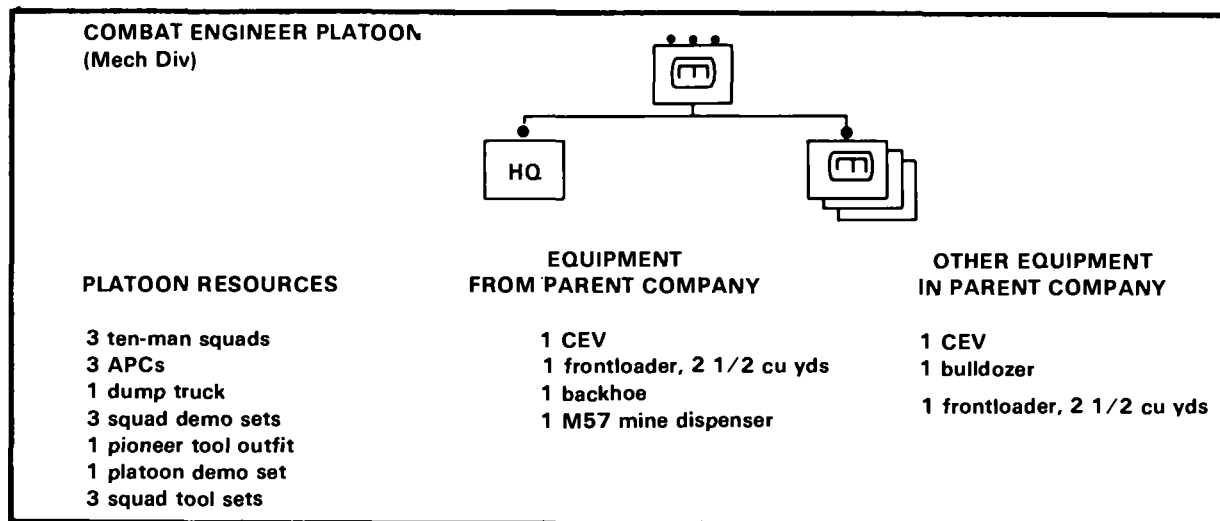


The commander's initial task is to plan to inflict maximum damage on the enemy's armored vehicles at long range. He then wants to fight a mobile battle from successive battle positions, continuing to damage the enemy and progressively weakening him.

He selects positions near the forward edge of his sector which provide long-range antitank fires. He plans to position the bulk of his TOWs and tanks on these positions initially. With this plan in mind the task force commander designates team battle positions. Each team will operate in varied terrain and must have multiple capabilities throughout the battle. Therefore, the task force commander organizes teams with similar balance of capabilities. To best utilize his forces he organizes three teams as follows:

TEAM A (mech info co HQ)	TEAM B (mech inf co HQ)	TEAM TANK (tank co HQ)
1-tank platoon	1-tank platoon	1-tank platoon
2-infantry platoons	2-infantry platoons	2-infantry platoons
3-TOW sections	3-TOW sections	2-TOW sections
1-81mm mortar section	1-81mm mortar section	2-HQ tanks

After the initial engagement, the commander must be prepared to fight a fluid battle in depth. He wants to wear down the enemy within his sector. Positions are therefore planned in depth. They will be occupied, abandoned, and reoccupied insofar as they offer an opportunity to inflict damage on the enemy.



ENGINEER ACTIVITIES

Before the Battle. A platoon from the division engineer company supporting the brigade is placed in DS of the task force.

The platoon is reinforced with a CEV, one frontloader, a backhoe, and an M57 mine dispenser.

The task force commander with the help of the engineer platoon leader must decide how to divide the engineer effort between the mobility, countermobility, and survivability tasks that the platoon can perform.

The task force commander decides that he wants the priority of engineer effort to go to the countermobility tasks along the center of the valley. This will reduce the enemy's mobility along avenues of approach 2 and hold him in areas where fires can be concentrated. In addition the commander wants TOW and tank positions improved, positions in the villages improved as much as possible, the other avenues of approach blocked and routes improved between battle positions. The following checklist is followed to insure as much work as possible can be done in the time allocated.

☒ List of work to be done: By TF cdr and engr plt ldr.

☒ Request for additional engineers: By TF cdr and engr plt ldr.

☒ Priority of work: By TF cdr and engr plt ldr.

☒ Request for special equipment: By engr plt ldr and engr company cdr.

☒ Allocation of resources: By engr plt ldr.

☒ Tasks maneuver forces will accomplish: By TF cdr and engr plt ldr.

Additional engineer assets are not available to the task force. However, the task force commander has been allocated six M56 helicopter-delivered mine missions (three two-helicopter sorties). One sortie is to be used for the forward minefield; two sorties are to be used for the minefield in the rear. Based on the recommendation of the engineer platoon leader the commander plans to utilize the scatterable mines for two minefields along the valley floor. The mine sorties will be on call and will be utilized after forward obstacles have been emplaced and the Threat has committed his forces along avenues of approach 2. The commander understands that because of the vulnerability of the helicopters, the

minefields must be in place before the Threat is close enough to cover the site with antiaircraft and small arms fire.

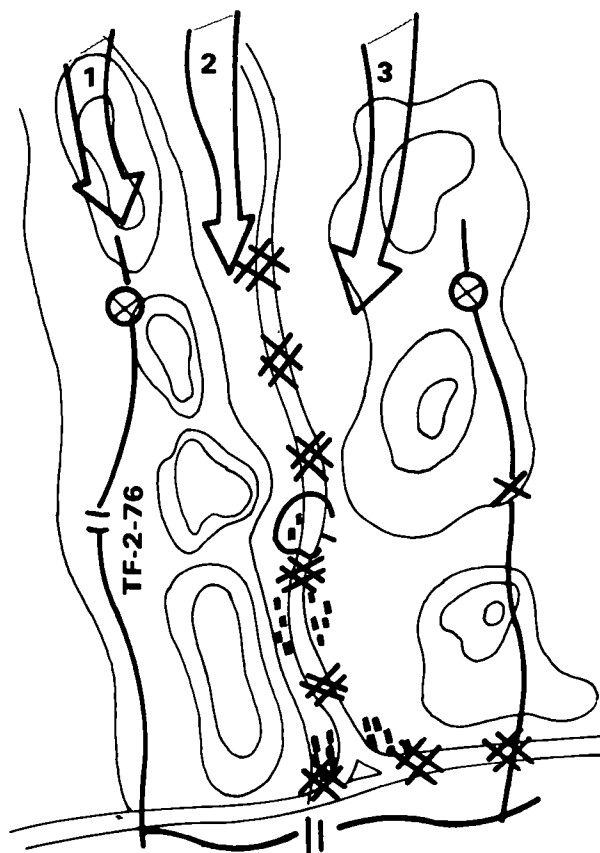
To perform the task assigned by the task force commander the engineer platoon leader allocates his resources as follows:

MISSION OF THE FIRST SQUAD

The first squad will prepare road craters on the high speed avenue of approach through the center of the valley. Priority of preparation will be from forward to the rear.

The squad will execute and mine the forward three road craters. Targets to the rear will be prepared for execution and will be turned over along with the required mines to maneuver team members.

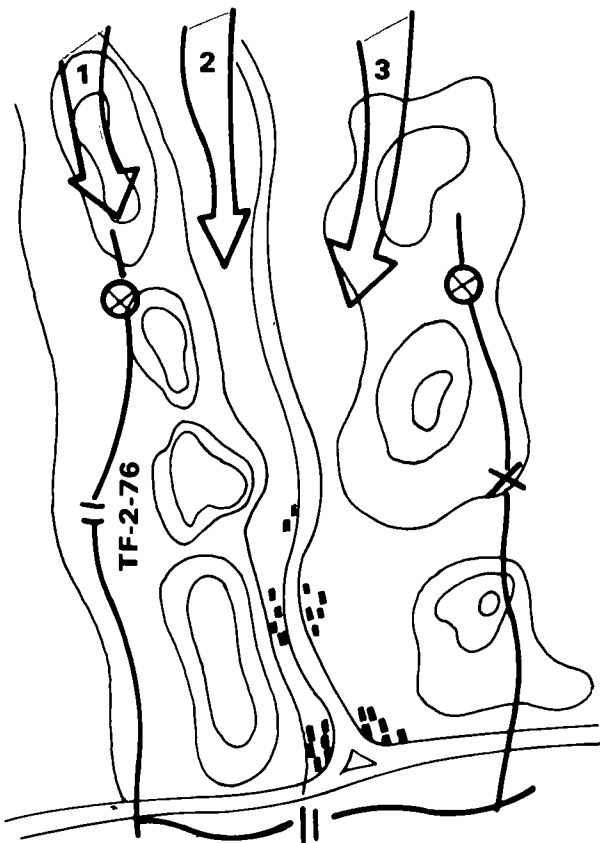
Upon completion of this task the squad will prepare craters and abatis on avenues of advance 1 and 3.

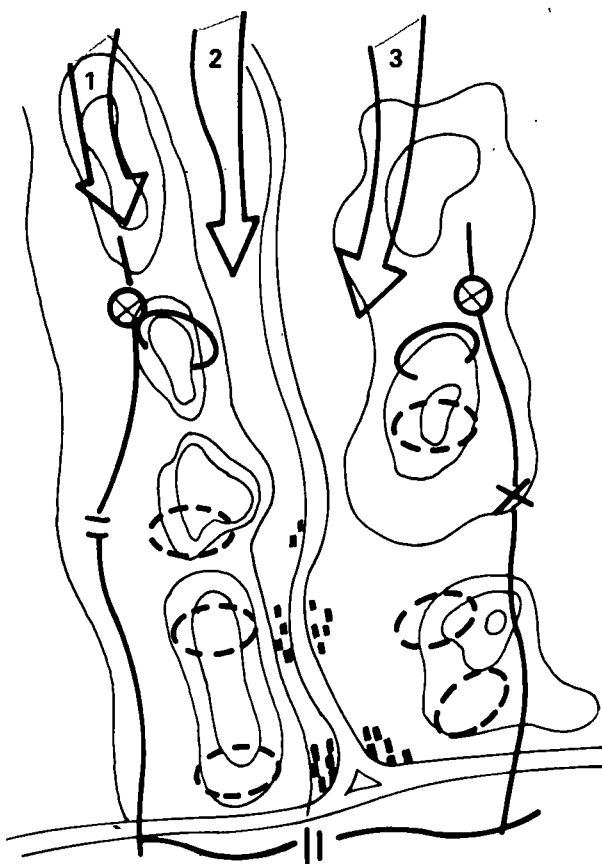


MISSION OF THE SECOND SQUAD

The second squad assisted by the platoon leader and two infantry squads will lay six minefields in the valley. For this mission the squad has been reinforced with the M57 mine planter.

Each minefield is 100 to 200 meters long having a density of 1-0-0. The infantry squads provide assistance in the operation of the M57. These minefields will be completed in 4 hours at which time the infantry squads will be returned to their platoons, the M57 returned to the engineer company and the engineer squad will begin working in the villages. In the villages the squad will improve TOW and tank positions and construct rubble obstacles and craters.





MISSION OF THE THIRD SQUAD

The third squad with the backhoe and the frontloader will construct firing and protective positions for TOWs, tanks, and APCs for each of the battle positions not in the valley. The squad will be augmented with the CEV.

The CEV will be used to improve and extend combat trails between battle positions. In addition to this task the CEV will help prepare firing positions for the tanks.

During the Battle. The engineer support to the maneuver elements will be continuous throughout the battle. When the Threat moves into the sector work on the most forward, exposed obstacles and protective positions will be terminated. Equipment will be moved to worksites which are not subject to direct fire and continue to accomplish engineer tasks for the maneuver force.

The engineer squads will continue to work in the most forward areas to execute or close lanes in prepared obstacles.

In conjunction with the task force commander's initial priority list, the engineer platoon will work on tasks in the following order:

Continue to place and improve obstacles, particularly in and around the villages.

Continue to construct and improve TOW, tank and APC positions in the rear battle positions.

Clearing routes between the battle positions especially if battle damage hinders or prevents movement.

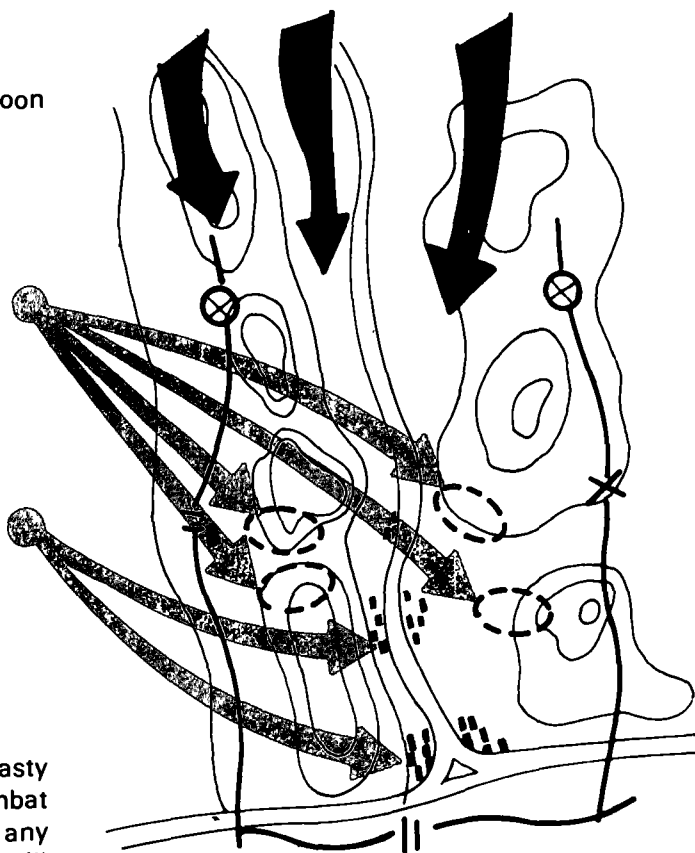
To perform these tasks the engineer platoon leader allocates his resources as follows:

One squad with the backhoe and frontloader to continue firing position for the TOWs, tanks, and APCs.

One squad in each of the villages to place obstacles and to improve firing positions.

The CEV will be used in the villages to create and move rubble.

The platoon leader will conduct a hasty reconnaissance to insure that adequate combat trails exist between the battle positions. If any work is required, the CEV or front loader will be diverted to this task.





Chapter 5

RETROGRADE OPERATIONS

Engineers have a critical role in the conduct of a retrograde operation. Though requirements for engineer support are similar in defensive and retrograde operations there is a greater engineer emphasis on installation of obstacles to impede enemy mobility during the retrograde. Using this and other engineer capabilities, engineers seek to improve the mobility and survivability differential between the friendly and enemy forces.

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Section 1

INTRODUCTION

PURPOSE

Retrograde Operations Are Undertaken To:

Trade space for time — DELAY

Disengage from enemy contact — WITHDRAWAL

Move away from an area without enemy pressure — RETIREMENT

WHEN TO CONDUCT RETROGRADE

A retrograde movement may be necessary, when:

There are insufficient forces to attack or defend, making it necessary to exchange space for time.

The command is to be employed elsewhere or in a better position.

Continuation of an operation no longer promises success.

The purpose of the ongoing operation has been achieved.

DELAY

In a delay mission, a force conducts any or all types of combat operations in order to gain time for something else to happen — reinforcements to arrive, or forces to concentrate elsewhere. Combat operations executed in the delay mission may include attack, defend, ambush, raid, feint, or any others appropriate to mission accomplishment.

Normally, a delay mission will be an economy-of-force operation; the delaying force may expect to fight outnumbered. If the force cannot defend successfully in place, it must trade space for time. Nonetheless, a commander assigned a delay mission should not assume that his force will always be defending or withdrawing. There may be situations where it is better for the delaying force to attack than to defend or withdraw. The enemy generally is delayed the most when his losses are high, so the delaying force seeks, by whatever means possible, to inflict maximum casualties on the enemy.

For larger forces (brigades and divisions), a delay is usually a time-limited or terrain limited, or both, series of defensive actions. A delay operation denies the enemy access to a specified area for a specified time, inflicting on him the maximum possible casualties that can be expected. A covering force might be ordered to fight the enemy forward of a specified area for a specified time (perhaps 72 hours).

The concept of the delay is to force the enemy to take the time to concentrate enough combat power again and again, against successive battle positions to overcome each in turn. The delaying commander places platoons or companies in battle positions which optimize their weapons effectiveness and at the same time minimize their vulnerability to enemy long-range observation and fires. The commander selects terrain which requires the enemy to travel along expected approaches. When time permits, he reinforces natural terrain obstacles, creates new obstacles, and places mines to hold up enemy forces in the field of fire of defensive weapons.

Delay is also a mission frequently assigned units in a flank guard, rear guard or in a covering force.

WITHDRAWAL

Withdrawal is a disengagement from the enemy. Disengagement is a difficult task; its timing is critical. Waiting too long may make disengagement most difficult, even impossible. It is desirable to break away quickly and with as little notice as possible. Sometimes, however, feints, diversions, or even attacks may be necessary to effect disengagement. Night and bad weather help the disengaging force to get away unnoticed, but at the same time make control of the disengaging force more difficult. Armor and mechanized units may be able to break away rapidly, quickly putting distance between themselves and the enemy before the enemy can react. Unarmored units, however, must usually depend on smoke, night, deception, clever use of terrain, or even attack to achieve

a clean break. The routes of withdrawal must be kept clear of obstacles or congestion that would hinder movement of the units.

Normally radio silence should be imposed on units that have disengaged. Until disengagement is complete, the remaining forces should simulate, as nearly as possible, continued presence of the main body. They may do this by stepping up combat activity levels, or by attacking. This force must have specific instructions about what to do when the enemy attacks, and when and under what circumstances to withdraw. An armored unit may wait for the next enemy attack, then conduct a delay to facilitate withdrawal of the main body.

Army aviation is especially valuable in support of disengagement and the ensuing withdrawal. Air cavalry and attack helicopters can be used in feints, diversions, and raids; on flanks; and to hold up attacking armored forces. Lift helicopters can assist in any or all of the disengagement phases.

RETIREMENT

Since, by definition, a retirement is conducted in the absence of enemy pressure, it is therefore a battlefield movement which should be conducted according to techniques of movement appropriate to the level of command.

THREAT PURSUIT CAPABILITIES AND ACTIONS

With the possible exception of retirement, whenever our forces are engaged in retrograde operations, they can normally expect to be pursued by Threat forces.

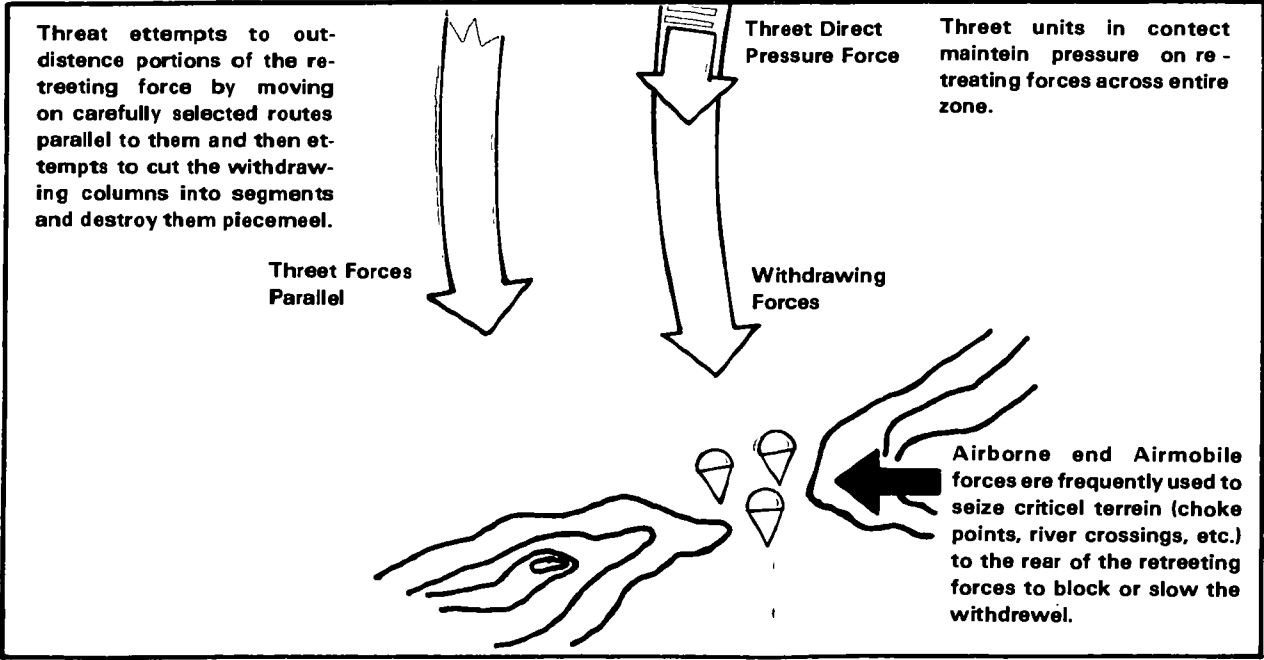
The Threat forces consider pursuit as an integral part of all offensive actions. It is planned for prior to commencing either advance to contact or breakthrough operations and follows as a natural extension to these operations. His pursuit is designed to complete the destruction of our forces.

Threat forces begin their pursuit when our force is either routed or attempts to break contact in a preplanned retrograde operation. All Threat commanders have a

duty to maintain contact and are expected to take up pursuit without further orders. When the motorized rifle division initiates the pursuit, tanks of the medium tank regiment, supported by motorized rifle units, parallel the lines of our withdrawal to block, cut off, and destroy segments of our columns. Direct pressure on our units in contact is increased across the entire zone of action so as to make the format of our march columns difficult. Second echelon regiments are moved forward in the main direction of pursuit and prepared

for early commitment. The pursuit is terminated only on orders of army or higher commanders. Orders to terminate the pursuit are normally issued when the retrograding forces have been completely destroyed, when the Threat forces have outdistanced their support (or are over-extended), or when the retrograding force has succeeded in establishing a strong defensive position. When the pursuit ends, units are regrouped and redeployed for the next operation.

DISENGAGEMENT SEQUENCES	
Disengagement generally takes place in several overlapping phases:	
IN POSITION	WITHDRAWN/DISENGAGED
	EARLY EVACUATION OF CASUALTIES
	EARLY EVACUATION OF RECOVERABLE COMBAT EQUIPMENT
	EVACUATION OF SUPPLIES AND LOGISTICS SUPPORT OPERATIONS
	REMOVAL OF ALL BUT ESSENTIAL COMMAND AND CONTROL FACILITIES
	DEVELOPMENT OF OBSTACLES TO PURSUIT BY REINFORCING OBSTACLES WHEN POSSIBLE
	DISENGAGEMENT OF THE MAIN BODY
	DISENGAGEMENT OF REMAINING FORCES OR SECURITY ELEMENTS



Section II

ENGINEER SYSTEM IN THE RETROGRADE

GENERAL CONSIDERATIONS

This section will be brief because of the similarity between divisional engineer effort of the retrograde and the support of the defense. This similarity in divisional engineer effort exists because of the similarity in maneuver unit action, at least at lower levels, in the active defense and the delay. Engineer actions must be tied very closely to the actions of the forces they are supporting. A few basics however, should be considered.

Withdrawal routes must be kept open. This does *not* mean only a limited number of primary routes leading to the rear which are the responsibility of corps engineers. This *does* mean tactical withdrawal routes used primarily by maneuver units and combat support elements in moving from one delay position to another. Thus, these routes may not even be roads, as the primary consideration in selecting them is cover and concealment from enemy observation and fire. Combat engineer vehicles (CEV) and armored vehicle launched bridges (AVLB) will be key items of equipment in this effort.

Keeping withdrawal routes open requires engineer effort, but the *majority of the division engineer effort is employed on the installation of obstacles to impede the movement of the enemy*. These obstacles are employed in depth and oriented along primary avenues of approach.

Corps engineer units are tasked to prepare defensive positions to the rear. Although coordination with division engineer and maneuver units is essential, time for coordination will be very limited. Therefore, thorough planning for these rear defensive positions is critical.

MOBILITY

A division conducting retrograde operations must possess tactical mobility equal to, or greater than, the opposing force. Tactical mobility is the ability to move about the battlefield under fire. Mobility, then, is a function of terrain, weather, obstacles, speed, and vulnerability. The excellent cross-country mobility and the armor protection of

the tank and armored personnel carrier are important capabilities for retrograde operations. The division increases its mobility by:

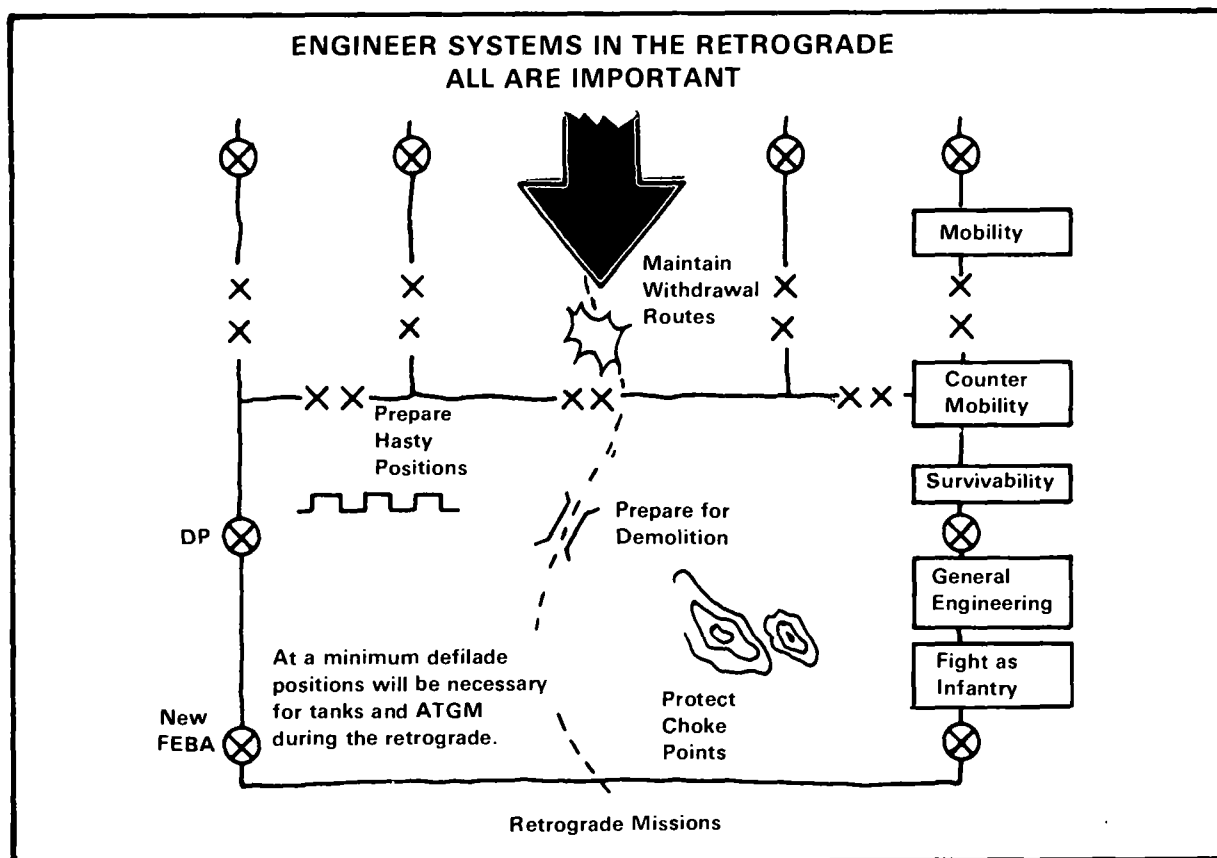
Carefully reconnoitering and preparing lateral routes and routes of withdrawal, including establishing traffic control points.

Disengaging and withdrawing elements or units that lack adequate mobility prior to the main body retrograde operation.

Conducting rearward movement during reduced visibility over previously reconnoitered routes.

Using highly mobile forces to cover the withdrawal of less mobile units.

The division engineer considers every means possible to improve the mobility differential between the division's forces and those of the enemy.



Breaching of Interdictory Obstacles

Interdictory obstacles may be expected in withdrawal operations. To isolate units and disrupt the withdrawal, the enemy primarily will be employing airborne and airmobile forces to emplace mines along chokepoints, river crossing areas, and to the rear. Assault breaching techniques will be employed to clear these mines as rapidly as possible to prevent isolation of the covering force. Line charges and rollers will be the principal pieces of equipment employed. Bangalore torpedoes and M173 projected charges can be used to augment this equipment if necessary, but the method will be relatively slow. Breaching equipment and devices should be located uniformly throughout the retrograding force since it will be impossible to determine when or where scatterable mines will be employed.

Retrograde River Crossing Operations

Retrograde river crossing operations are *not* the exact reverse of offensive river crossings. The friendly forces control the terrain to the rear and thus have the capability to use all available crossing means. If the terrain was occupied for some time, tactical bridging would have been replaced with more permanent bridging. Additionally, existing permanent bridges would have been repaired or replaced. These structures, which can be prepared for rapid destruction, provide the best retrograde crossing facilities. Tactical bridging which is able to quickly disperse and egress (e.g. MAB) can also be installed for use by the withdrawing units. However, bridging which requires a relatively large recovery time (e.g. M4T6) must be removed early in the operation or destroyed in place to avoid capture by enemy forces.

Use of Deception

If the enemy becomes aware that a river crossing is critical to the success of a retrograde operation, he will make every effort to destroy or capture the crossing forces.

Deception must play a large part in thwarting such efforts. The combat engineer

places emphasis on:

Bridge construction by night.

Clearance of all unnecessary vehicles from crossing sites.

Dismantling, dispersing, and concealing, bridges and rafts when their use is not imminent.

Use of decoy crossing sites.

Coordination of crossing traffic to avoid lucrative targets.

However, emphasis on deception or concealment must not prevent the tactical bridging from being in the configuration necessary to support the retrograde plan. For example, a bridge should be dispersed when it is not needed over an *extended* period of time.

This bridging must be available when forces are to be crossed, either night or day. Accordingly, the specific deception technique adopted must be used with sufficient flexibility to satisfy the mission requirements. See appendix F for a more detailed discussion of retrograde river crossings.

Withdrawal Routes

Road maintenance in retrograde operations will be limited to the minimum essential work to insure withdrawal of the forces. Since the withdrawal routes are in our hands and have been in use, maintenance problems should be significantly reduced. Increased traffic and adverse weather speeds road deterioration. Therefore, engineer units should be assigned missions along critical withdrawal routes. For the most part, these tasks should be assigned to *nondivisional engineer units*. Engineer companies in support of the brigades in contact are concerned only with the expedient repair of the combat roads used by the brigade. They may well be preparing obstacles on these roads to hinder the advance of the enemy, therefore, *noncritical* road repair in any detail is counterproductive to the retrograde.

Engineer units with the forward security force should be tailored to accomplish breaching and rearward mobility tasks. Mine rollers, along with conventional breaching charges, must be located here. The AVLB and dozers should also be located with this force. Conventional earthmoving equipment and engineer handtools will accompany the forward security element.

COUNTERMOBILITY

Role of Engineers.

The integration of engineer tasks into the actions of the combined arms team is essential to deter enemy movement. The success of the withdrawal is dependent upon the mobility of the withdrawing force and the ability to *impede* the mobility of the enemy. Engineer troops and equipment that can create obstacles should stay with the rear security element and withdrawal security force to impede enemy mobility and conduct denial operations. To a lesser degree, engineers are placed with flank security elements to emplace obstacles to reduce the vulnerability of the main body to enemy flanking attacks.

Brigade Engineer Responsibilities.

Engineer effort must be provided to the security or covering force in addition to the main body. One of the most important functions of the brigade engineer is to formulate, plan, and carry out the obstacle plan. Engineer platoons are placed in direct support of maneuver battalions. Detailed plans are prepared for conventional and atomic demolitions along enemy avenues of approach and those routes which lead into the brigade sector. Particular attention is given to the destruction of bridges, tunnels, and supplies and equipment that cannot be evacuated. The brigade engineer and division engineer must coordinate closely with corps engineer units to the rear and be prepared to close lanes and gaps in corps emplaced obstacle systems when corps units are relieved for deployment to the rear.

Corps Engineer Responsibilities.

Corps engineers impede the advance of the

enemy through planned destruction of installations, supplies, structures, and routes of advance to prevent their use by opposing forces.

Certain obstacles cannot be executed until all friendly forces have withdrawn. It is a corps responsibility to plan for the rapid closing of these areas to deter enemy movement. It may be necessary to designate certain obstacles as reserve demolition targets. These targets are made ready for execution, but not executed until approval is received from the authorizing commander. Close coordination must be effected between corps and division so friendly units are not isolated.

Employment of Obstacles

Obstacle emplacement usually extends over a much greater area for retrograde than for defense. Obstacles are needed at appropriate locations from the forward edge of the covering force area or from the initial delay position to the new position where the retrograde will end. Obstacles are used during the delay to:

Slow and break up the enemy's advance while maneuver elements withdraw.

Canalize the enemy's advance into areas where friendly weapons are most effective.

Cover the areas where antiarmor weapon deadspace exists.

In the *withdrawal*, obstacles should slow and break up the enemy advance while maneuver elements withdraw. In the *delay*, obstacles should canalize the enemy advance into zones where he is vulnerable to antiarmor weapons.

The obstacle system must be located to mutually support the positions selected by the tactical commander, and *the priority will go to those obstacles which enhance weapon effectiveness*. Time will be critical, so the primary means of accomplishing this task will be through the use of preplanned

demolition targets, scatterable minefields, and point type obstacles. Siting of these obstacles by the brigade engineer and the tactical commander must enhance prepared delay positions by allowing reduction of enemy forces at the maximum effective range of the direct fire weapon systems.

Surveillance, target acquisition, and night observation (STANO) devices can be emplaced and used in conjunction with artillery fire to prevent easy removal of emplaced obstacles.

Reserve Demolition Targets

Some demolition targets are executed only on the direct authority of a certain tactical commander. These key targets are needed to insure that all friendly forces have a withdrawal route and none will be isolated by the friendly obstacle system. Reserve demolition targets are prepared for destruction by engineers, guarded by a maneuver unit, and then executed upon receipt of proper authority. This allows the division engineers to remain forward with the withdrawing forces.

THREE commanders normally are concerned with the execution of a demolition target:

1 The military authority who has overall responsibility, i.e., the officer empowered to order the firing of the demolition (referred to hereafter as *the authorized commander*).

2 The commander of the *demolition guard*.

3 The commander of the *demolition firing party*.

The authorized commander--

Determines the requirement and allots responsibility for a demolition guard.

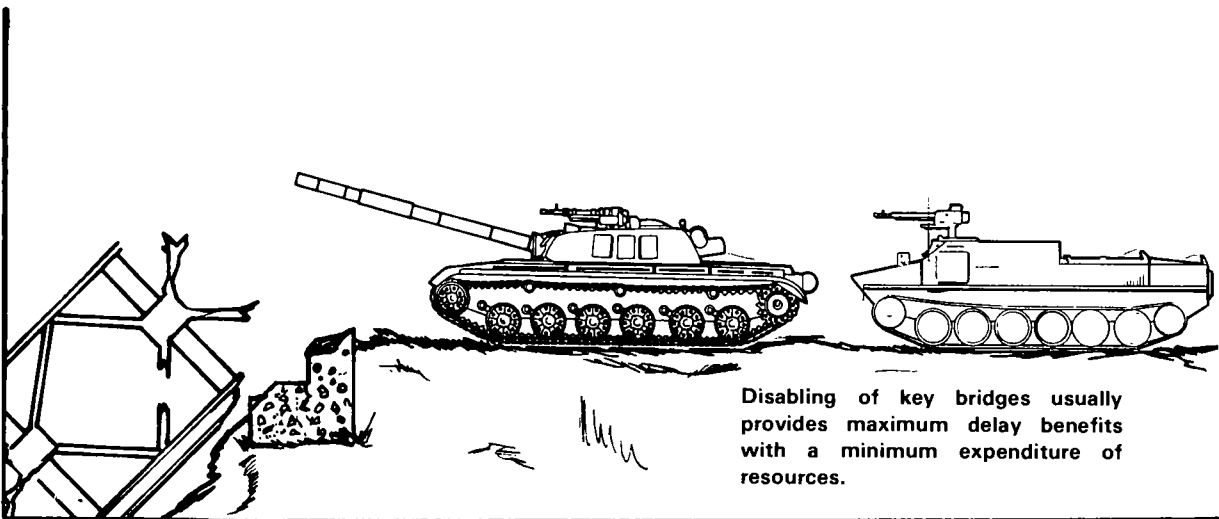
Establishes a clear cut channel from himself to the commander of the demolition guard for transmission of the order to fire the demolition.

Insures that this channel is known and understood by all concerned.

Insures a positive, secure means for transmitting the order to fire.

Specifies whether the demolition guard commander is authorized to order the firing of the demolition on his own initiative if the enemy is in the act of capturing it.

Provides a list of all units that are to use the target.



The authorized commander appoints a *demolition guard*, the commander of which is responsible for —

Insuring, if so ordered, that the demolition is not captured intact by the enemy, and

Giving to the demolition firing party commander the orders for changing the state of readiness of the demolition and the firing orders. The demolition guard may also fire the demolitions on certain obstacles, thus releasing engineers to emplace and execute other targets.

The demolition firing party commander is the individual responsible to prepare the target for demolition and to execute it on order.

It is desirable that DA Form 2050-R be used for the orders to the commander of a demolition firing party. It is essential that he be given orders that cover all the information on the form. The commander of the demolition guard and the demolition firing party are given these orders. They retain the orders until they execute the demolitions.

SURVIVABILITY

The maneuver forces performing delaying actions during the retrograde need fallback positions. In the retrograde, protective shelter must be provided for the delaying forces both within the delay area and in the fallback positions they are to occupy.

It can be expected that the delay forces will reoccupy positions that were prepared during the offense and defense, but terrain features that were critical during previous operations may not be critical during a retrograde. The changing situation may require units to occupy terrain that was *not* previously prepared or fortified during the offense or defense. Further, the tactical commander may want to avoid previously occupied defenses because of the Threat force's

knowledge of their vulnerabilities. The engineer normally will prepare positions which company-sized delaying elements may occupy. To accomplish this requirement, a representative of the tactical unit should be available to explain specific needs for the positioning of critical weapons. For the delay forces, most work will consist of vehicle defilade and other hastily constructed fighting positions.

The engineer must know the route of withdrawal and the sequence of events to adequately schedule his effort. The priority given to various phase lines (delay areas) by the tactical commander, and the time available to prepare defenses within each area will provide the basis for allocating engineer resources. It is assumed that DIVISIONAL ENGINEERS will support the delaying elements by constructing blocking positions along various delay lines, maintaining withdrawal routes, and preparing obstacles to impede and channelize movement of the Threat forces. CORPS ENGINEERS will be completing fortifications and protective shelters along the final defensive line.

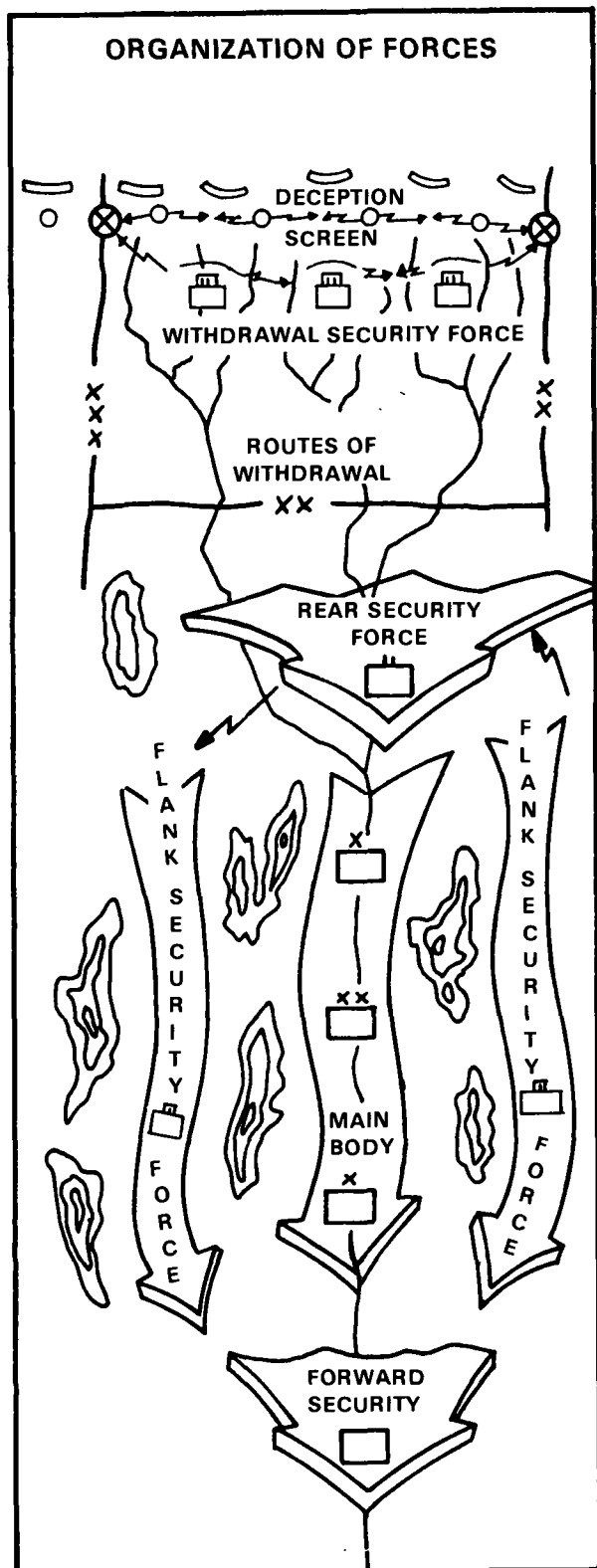
Work on the new defense positions, however, is more permanent in nature since time will be available for construction and the positions are planned for *defense*, not delay.

The enemy *must* not discover the real intent of activity associated with withdrawal operations until too late to launch an effective pursuit. Every activity in preparation and conduct of a withdrawal must be weighed against the risk of revealing the withdrawal.

Camouflage

The basic camouflage principles, techniques and equipment described in the chapter on defense also apply to the retrograde. The retrograde is characterized by movement, thus making it difficult to camouflage. When halted, proper use of camouflage is essential to survivability.

Deception



When enemy action is relatively light, a unit can sometimes slip away before the enemy realizes a retrograde is under way. Use of darkness, weather phenomena, electronic countermeasures, and every other means to deceive and confuse the enemy is intrinsic to withdrawal operations. Every soldier must be imbued with the vital part that his actions play, not only in his own survival, but in the survival of the withdrawing unit. Forces positioned to provide security for withdrawal strive to imitate the signature of the force preparing for offensive action. Notional units may be created by electronic activity among electronic warfare (EW) elements allocated by corps. Every feasible deceptive measure is used to reduce the risk of enemy pursuit of the withdrawing force. Deception could include any of the following:

A strong counterattack to throw the enemy off balance and occupy his attention.

Concentration of troops as if in preparation of counterattack.

Electronic countermeasures (ECM) against enemy signal intelligence collectors.

Deceptive communication before, during, and after withdrawal of the main body.

GENERAL ENGINEERING

It has been emphasized earlier in this chapter that retrograde operations are characterized by centralized planning. For corps engineers, this centralized planning begins when the corps engineer, through his corps engineer section, determines the best way to apply available engineer resources to support the concept of the operation as stated by the corps commander. It continues when his broad recommendations, as approved by the corps commander, are translated into specific requirements and missions for designated units by the staff of the corps engineer brigade. In planning at corps level, the engineer staff and the brigade staff must

look at the entire operation. Engineer assets must be matched against known or anticipated requirements from the current line of contact all the way to the rear of the new position. This must be done, keeping in mind the overall objectives of the retrograde, to insure that priorities are set for the requirements. The source of engineer effort in the retrograde normally is nondivisional engineer units. Close coordination with these units is required to insure their effort is expended on tasks which complement the retrograde. In this regard, several items deserve special consideration:

Withdrawal Routes

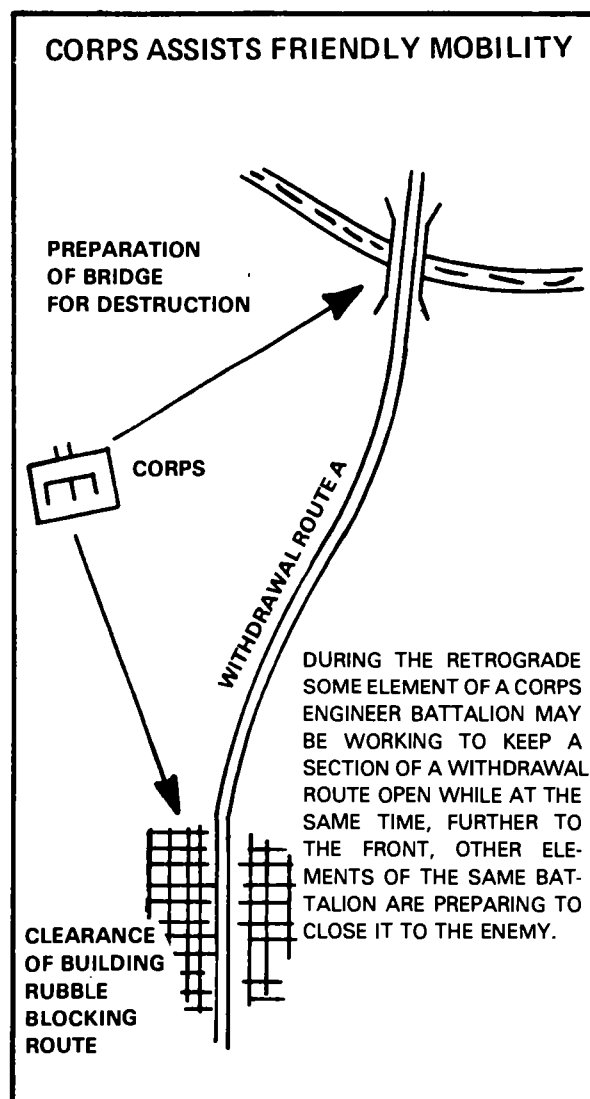
Of prime concern to the corps engineer will be those routes over which the major elements of the corps will move to the rear.

Corps engineer plans must emphasize keeping these routes open. This means not only counteracting the wear and tear that will be caused by the heavy volume of traffic to the rear, but having engineer units positioned and prepared to instantly repair damage inflicted by the enemy as he attempts to stop friendly movement.

If the route encompasses the crossing of a major river obstacle, then engineer support of that crossing will be of critical importance.

Withdrawal routes will be closed to the enemy after friendly forces have moved to the rear. Although most obstacles will be executed by divisional elements, corps engineer plans must take into account the emplacement of obstacles and the progressive blocking of less critical routes as our forces pass to the rear. Timing and coordination in this process will be critical.

Division engineer units will be committed in support of the withdrawing forces. For this reason, nondivisional engineer resources should be used to provide the crossing means for the withdrawing forces. Engineer effort will be limited to the

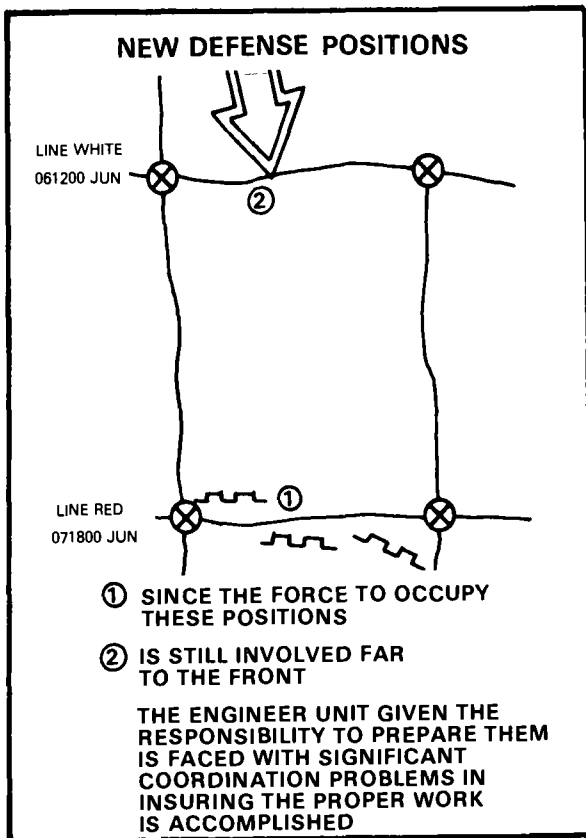


minimum essential to insure the withdrawal of friendly forces. Priorities are as follows:

First priority - repair of existing bridges.

Second priority - construction of temporary tactical bridging.

Airfield maintenance required to support the retrograde is limited to bomb damage repair and expedient surfacing. It will be undertaken by corps units to allow resupply, equipment evacuation, or combat air support.



Defensive Position

Another area which must be addressed in corps engineer plans is preparation of the new position to be occupied after the retrograde.

This is a task of large proportion because it includes not only obstacle and fortification work on actual fighting positions, but also all the preparation required to reestablish the critical combat support facilities required to sustain the operation.

Depending on the extent of the retrograde, maximum utilization should be made of facilities which are evacuated in the COMMZ. Likewise, divisions may be able to make use of former corps facilities. Such use may be critical in freeing more corps engineers for employment in close combat support roles.

REFUGEE CONTROL

Refugee control is a significant burden in retrograde operations. Plans for control must be made in advance and include:

Early issuance of directives for refugee control.

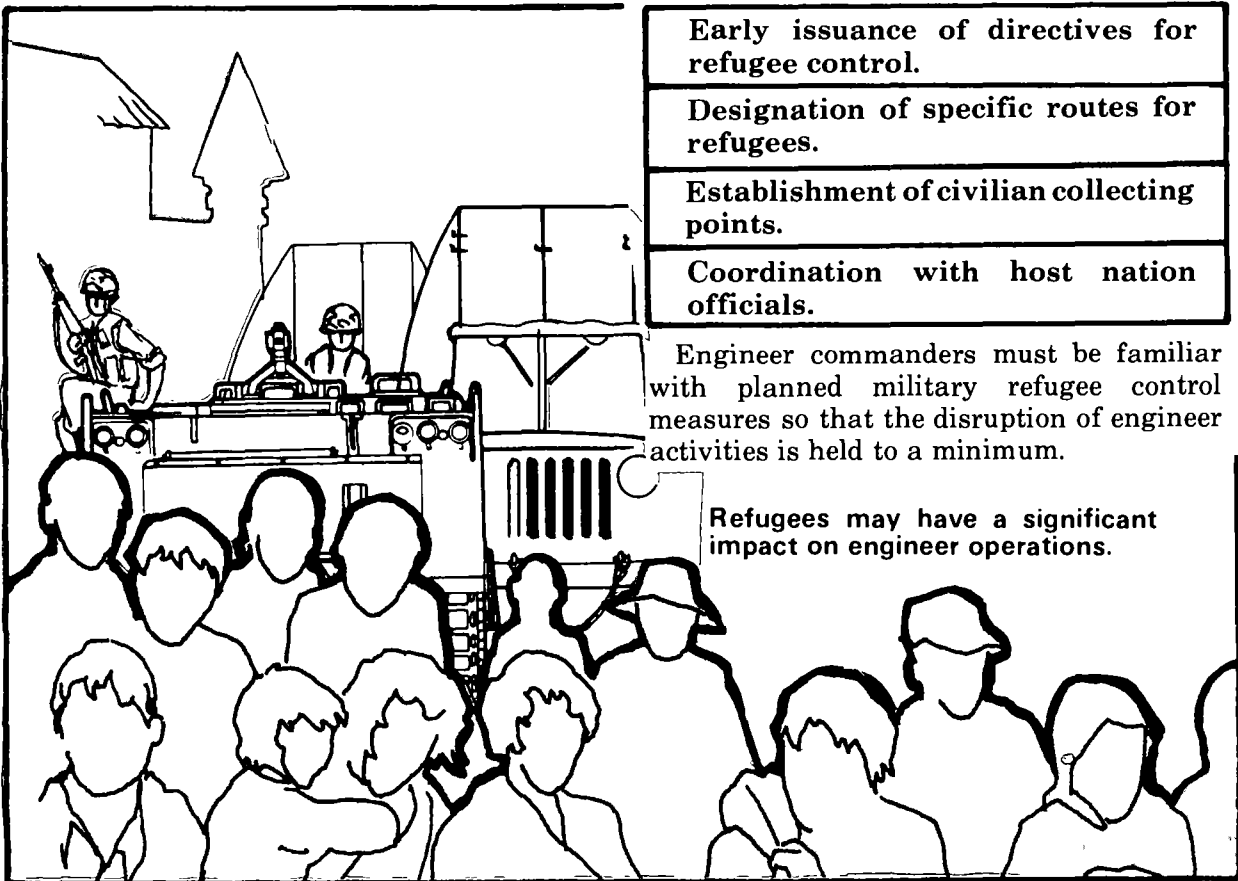
Designation of specific routes for refugees.

Establishment of civilian collecting points.

Coordination with host nation officials.

Engineer commanders must be familiar with planned military refugee control measures so that the disruption of engineer activities is held to a minimum.

Refugees may have a significant impact on engineer operations.



DENIAL OPERATIONS

The destruction of a denial target, such as a key highway bridge on a lateral route, may slow enemy tactical movement directly. In most cases, however, this destruction will indirectly hinder the overall operation of the enemy. It will deny him the tactical or strategic benefits of those areas that he captures. He will be forced to expend more of his own resources to sustain his forces. Although the initial planning of denial operations begins at theater or higher level, combat engineers at corps and division level frequently become closely involved in their planning and execution. This is because explosives for the destruction of a target is the most common method of denial, and engineers have the special knowledge and skills to perform such work.

Authorization to execute denial operations is vested in the theater commander. Within the national (or multinational) policies and limitations, he will establish basic policies governing denial operations and will delegate responsibility for planning and execution to subordinate commanders. Extensive consideration is given to those facilities and areas that may be required later to support friendly operations and/or post hostility actions. This is due in part to the long range economic, political, and psychological effects of excessive destruction. It is also due to the consideration of both the short, intermediate and long range impact of destructive denial. Execution of denial operations is usually tightly controlled, and planning is detailed and extensive. Considerations to minimize unnecessary destruction affect the extent of denial. Nevertheless, the primary factor determining denial priorities must be the impact of the destruction on winning the battle and the war. Coordination is essential to insure that denial operations will not isolate friendly elements in contact with the enemy. Targets will be destroyed only after their use by friendly units is completed. Firing parties must be given well-defined instructions.

Denial plans and policies provide information on:

Specific target areas (facilities) and items to be denied.
Degree of denial (destruction or evacuation).
Priority for preparation and execution.
Command channels that will apply for the specific target.
Assignment of planning and execution responsibility.
Assistance to be provided or desired for protecting the targets from enemy interference.
Availability of special denial teams.
Limitations on the means of destructive denial.
Use of contaminants and/or nuclear devices.
Safety and security measures to be followed.
National policy restrictions (if any) of United States or host nations.
Coordination required between US elements, joint commands, and allied forces.
Timing of planning and execution of the denial mission(s).
Allocations of available and local resources.

Within the broad concept of denial operations, the individual or organization recommending inclusion of a specific target into the denial operation(s) should consider the selection of those industrial, logistical, and communications systems which are vital to the enemy's operation.

Loss of this capability to the enemy should:

Disrupt his logistical support capabilities.

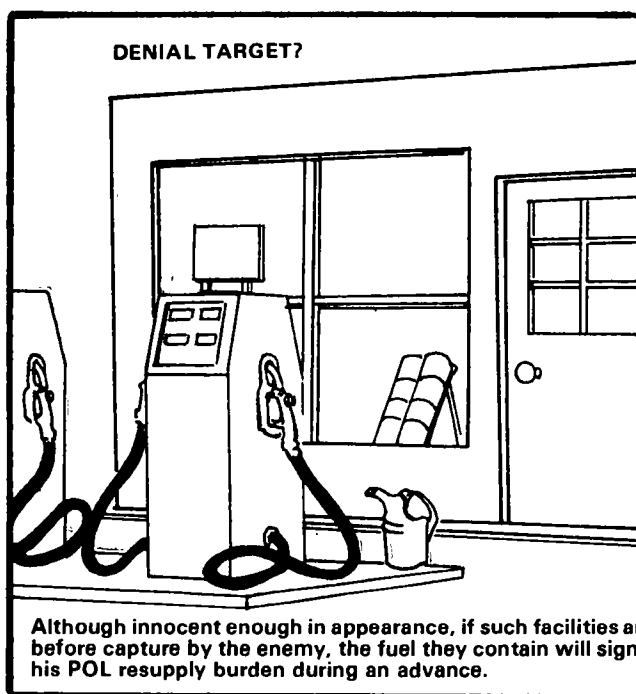
Prevent the use of local materials, supplies, and equipment to reinforce or augment his offensive capabilities.

Require the diversion of significant engineer and operational efforts for repair, reconstruction, or rehabilitation in the area.

Delay the movement and distribution of replacements, supplies, equipment and reserve units by forcing them to use secondary and low-speed routes of advance and movement.

Restrict his tactical or strategic mobility.

In accordance with the anticipated magnitude of denial operations and because of the limited time, materials, and manpower that will be available, all denial missions are assigned a priority of execution. These priorities are assigned according to the



extent to which the missions concerned will contribute to the overall friendly tactical operations. Those which have an immediate effect on current military operations will usually be assigned a priority above those which have only a long term effect on operations.

FIGHTING AS INFANTRY

Throughout the withdrawal, engineers must be prepared to fight as infantry. They must be prepared to defend withdrawal routes and bridges, provide covering fires on emplaced obstacles, and undertake the full spectrum of infantry missions.

When it is necessary for the division

engineer battalion to fight as infantry to insure a successful retrograde operation, additional engineers from the corps should be deployed forward to assume engineer tasks in the battle area.

Due to the wide dispersion of division engineer elements across the battlefield, company-sized units will probably fight as infantry rather than the entire battalion. A portion of the battalion may be fighting as infantry, while other battalion elements may still be performing engineer tasks. When individual companies fight as infantry, they should be in an attached status.

The emergencies which cause the reorganization of engineers to fight as infantry may prohibit the removal of engineer equipment from the battle area. Equipment parks should, however, be designated and equipment withdrawn when possible. When this is not possible, equipment unable to maintain the required mobility may be handed off to other engineer units or destroyed in place to prevent its use by the advancing enemy. The CEV and AVLB may have a direct impact on the outcome of the battle and should be retained with the engineer unit as long as possible.

As in other cases of reorganization, mobility and firepower are essential for the engineers in retrograde operations. When engineers are committed as infantry without augmentation of equipment, their capabilities are not that of an infantry unit of comparable strength.

COMMAND AND CONTROL

A retrograde operation is characterized by the integration of division and corps engineers at the lowest possible levels to support the maneuver units.

Normally, divisional engineer units will be attached to maneuver units in a retrograde operation. The retrograde operation requires close association between division engineer and corps engineer units.

Corps engineer battalions may be in support of, or attached to divisions. The division engineers coordinate their efforts to insure responsiveness in the fast-moving environment of the retrograde.

Section III RETROGRADE PLANNING SCENARIO

(See map pullouts at this time and keep them open.)

Commander, 1st Corps orders the 25th Armd Div, with 312th Sep Bde (Mech) attached, to conduct a delaying operation from LINE DANCER (SALVIG River) to LINE WOMBAT (LUDWEEN River) to cover the withdrawal of the 52d and 54th Inf Div (Mech). 52d and 54th Inf Div (Mech) with 23d Armd Div are to occupy the main battle area in the new defensive position. On completion of the delaying operation, 25th Armd Div with 312th Sep Bde (Mech) attached, reverts to corps reserve.

CG, 25th Armd Div orders delay of successive positions using his three brigades forward. 312th Sep Inf Bde (Mech) is to provide the reserve.

You are the ADE, 25th Armd Div.

Engineer planning steps to support a retrograde:

- STEP 1** Division Staff with ADE participation produces draft division Operation Order. (See DIV OPORD, pages 5-22 to 5-25.)
- STEP 2** Receive the following guidance from the Division Engineer and Division Staff.

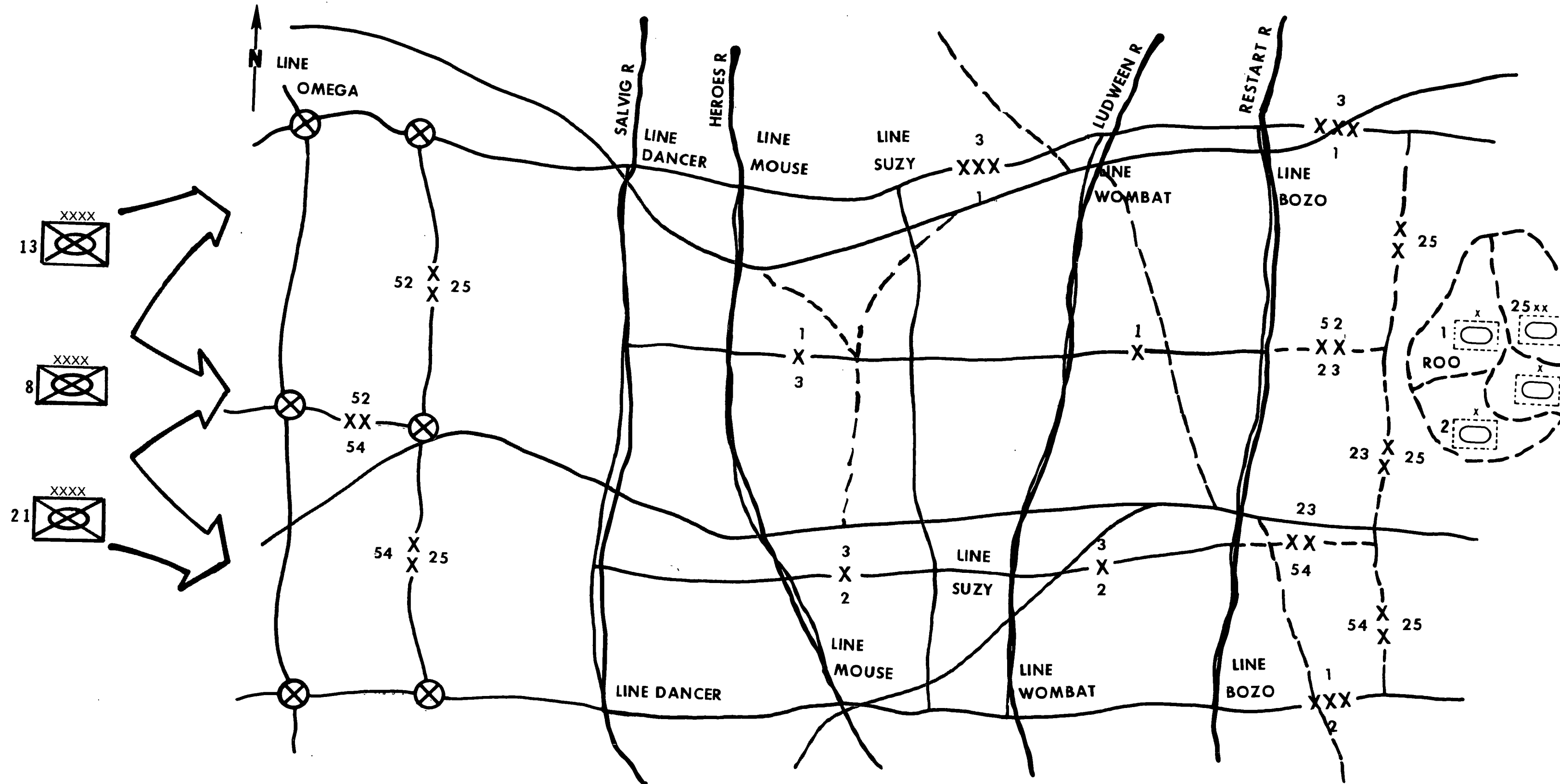
G-3 Guidance:

Estimates for achievable delays are:

1st DP (Line DANCER)	-12 hours
2d DP (Line MOUSE)	- 8 hours
3d DP (Line SUZY)	- 9 hours
4th DP (Line WOMBAT)	- 10 hours
Total delay PLANNED	-39 hours

Engineer work should be complete at:

DANCER	-012400 A Apr
MOUSE	-020130 A Apr
SUZY	-021930 A Apr
WOMBAT	-030430 A Apr



Engrs are to:

Prepare obstacles system

Assist in construction of delay positions

Provide normal combat support.

G-2 Guidance. Maps, air photos and reconnaissance information.

G-4 Guidance. Available quantities of Class IV and V materials.

Div Engr Guidance.

25th Engr Bn and 5095th Engr Co (the organic company of 312th Sep Bde) will work 16 hours per day.

Work on one DP can commence 2 hours after movement commences. Therefore, engineers are able to start work at 311600 A mar. Demolition target folders have been prepared. (Not included.)

To clarify in your own mind the time and space restrictions you must meet, you produced a timetable of known activities:

25 ARMD DIV DELAY

ACTION	PRESENT LOCATION	LINE DANCER	LINE MOUSE	LINE SUZY	LINE WOMBAT
REAR MOVE (except recon)	311400				It is imperative that the engineer effort spent on obstacles is coordinated to the maneuver commander's delay time schedule.
RECON COMPLETE		310600	311200		
OCCUPY		311600— 010100			
ASSIST PASSAGE OF LINES		010130— 020130			
DELAY (planning times)		020130— 021330 (12 hr)	021330— 022130 (8 hr)	022130— 030630 (9 hr)	030630— 031630 (10 hr)
ENGR WORK COMMENCES		31160			
ENGR WORK COMPLETE		012400	020130	021930	030430

STEP 3

Complete engineer effort requirements by doing an engineer staff estimate.

Prepare obstacle overlay to be integrated into the maneuver plan. (See map page 5-30.)

Design obstacles, describe targets, number them and complete estimate to deploy them. (See TARGET TABULATOR, page 5-26.)

Estimate work needed to establish delay position, assist division moves and provide other combat support. (See ENGINEER WORKLOAD, page 5-27.)

Consolidate obstacle target tabulation and engineer workload estimates to produce the total amount of engineer support required. This is done in foldout, page 5-27.

This consolidation shows in the 1st Bde area we required 5 engineer platoons plus an ADM plt from corps. This consolidation can be shown in the following table.

TABLE 5-1

TASK	NUMBER OF SQUADS BY SECTOR				TOTAL
	1st Bde	2d Bde	3d Bde	Div HQ	
OBSTACLES	9*	7	10		26
OTHER TASKS	6	5	5	1	17
TOTAL	15*	12	15	1	43**
* PLUS AN ADM PLT ** 2 PLT of CBT SPT CP REQUIRED					NOTE: Figures for 2d and 3d Bde have been assumed for this example.

STEP 4

Task organize the engineers to satisfy your estimate. In doing this you make up a table (see Table 5-2).

TABLE 5-2

REQUIREMENT		ASSETS
1 BDE	15 squads	25 Engr
2 BDE	12 squads	509th Engr Co
3 BDE	15 squads	2 plts. 5080th CBT SPT CO (1)
HQ DIV	1 squad	5520th Engr Plt (ADM) (1)
312th SEP BDE (MECH)		Note (1): Provided from corps

Complete the Engineer Task Organization for the Division OPORD.

STEP 5

ENGINEER TASK ORGANIZATION

1st BDE

A/25 Engr (attached)
D/25 Engr (—) (attached)
5520th Engr Plt (ADM)

3d BDE

C/25 Engr (attached)
B/502 Engr (—) (attached)

2d BDE

B/25 Engr (attached)
1/D/25 Engr (attached)

312 SEP BDE (Mech)

DIV TRPS

25 Engr (—)
5095th Engr Co (attached)
5080th CBT SPT CO (—)
(attached)

In completing the engineer task organization for the division, you should remember:

1- The engineers are attached to the brigades because of:

The wide distribution of engineer tasks being conducted by squad-sized groups.

The fluid type of operation.

The difficult, and possibly confused, working environment which will probably arise when pressed by the enemy.

The need for the brigade commander to have immediate response from his engineers.

2- The engineer company commander commands his company and the attached platoons and is the engineer staff officer to the brigade command.

3- Any tasks given to corps engineers should preferably be involved in obstacle construction along the rear delay positions rather than the more intimate combat support tasks involving fire and maneuver activities.

4- It's bad practice, and causes delay, for engineers to leave their tasks incomplete and have other engineers finish the mission.

5- Although there are now more engineers available than the estimate indicates, they can still be gainfully employed in a GS role. The division engineers are required to work on the delay positions when they finish their programmed tasks and as time becomes

available. The GS engineers can begin thus contributing to the delay imposed on the enemy.

STEP 6

Produce Engineer Annex. (See Engr Annex, page 5-28.)

Engineer Activities

Before the Battle

The available preparation time for any retrograde operations will be very short as the retrograde will normally follow on immediately after some other operation. Generally about one third of the units that were engaged in battle will be left in contact (to conduct a delay operation) with the enemy. The rest will normally withdraw or retire to secure a new defensive line. This means that the majority of engineers will be used in a mobility improvement role on such tasks as route maintenance, bypass of obstacles, relief of bottlenecks and reverse river crossing operations, as well as assisting with countermobility and survivability tasks on the new position.

In the meantime, a reorganization of forces in contact with the enemy occurs. The remaining portion of the force has to space itself out across the front and provide sufficient opposition to the enemy to achieve the delay required. In trading space for time maximum casualties must be inflicted on the enemy. To assist in this, the engineers at the lowest possible level must plan the placement of obstacles so that the synergism of terrain obstacles and weapon systems is maximized and unit combat effectiveness is strengthened. At the same time, countermobility operations must not be allowed to unnecessarily restrict our own forces mobility, and effort must be available to insure our own forces' mobility and survivability.

Before arriving in the 1st Brigade sector, the company commander, A/25 Engineer, has already coordinated with the Brigade Commander and S3 and received the Brigade Operation Order. He knows that the brigade intends to fight a delay on successive

positions and that maximum casualties are to be inflicted on the enemy while keeping our casualties to a minimum. The brigade intends to use local counterattacks with armor heavy teams on these successive positions to inflict these casualties. Therefore, all obstacles used to enhance the firepower of the force must be placed so that they do not hinder the mobility of the force.

In addition, some of his available resources must be employed on survivability tasks on the successive positions. Withdrawal routes between these positions must also be maintained. This procedure will require the careful placing of gaps and lanes in all obstacles. Continued coordination must be maintained with brigade and task force headquarters.

The first priority of engineer effort is on the IDP. To shorten the time required for reconnaissance, the company commander must use all his available platoon commanders to conduct the reconnaissance and design the obstacles in relation to the delay positions and materials available. Any gross variations from the division plan must be quickly identified, adjustments made, and additional materials ordered, if available. Also, any obstacles previously placed by the 52d and 54th Mechanized Infantry Division must be identified and utilized.

While the reconnaissance is continuing, all company elements will be deployed to perform identified tasks. All the company equipment would be deployed to task force sectors to develop the IDP. Each platoon would be assigned specific obstacles within its capability. For example, 1/A/25 Engineer would be assigned in direct support of the southern task force with the responsibility, initially, for obstacles 25-XX-1005, 25-XX-1012, 25-XX-1009, 25-XX-1015, in that priority. It would also be given a backhoe-loader and a company of infantry to assist in obstacle development and a 2½ cubic yard loader for survivability tasks in addition to its platoon resources. Similar deployments would occur for three of the other four platoons.

The other available platoon would be tasked to set up the reserve demolition 25-XX-1014 on LINE MOUSE and develop positions for tanks and TOWs on LINE MOUSE. Representatives of the task forces must be present on LINE MOUSE to insure the correct location of these positions. The ADM platoon would immediately be deployed to target 25-XX-1024, and the squads to assist on that target would be available after the occupation at LINE MOUSE.

All other targets would be developed by platoons within the task force sectors with priorities determined by the TF Commander, generally from front to rear. Careful attention must be given to reserve demolitions to make sure that the division commander's requirements are met. But the available effort from the company must not be seriously depleted because of the requirement for demolition firing parties.

To insure both the timely and adequate resupply of the fighting elements and the orderly rearward movement of the force, route maintenance must be carefully considered. This may be handled by assets still under the control of the 25th Engineer Battalion. Elements of the 5095th Engineer Company and the platoons of the 5080th Engineer Company (LES) may be deployed in general support on these tasks.

During the Battle

Once the battle begins the company commander must keep fully informed of progress by keeping in touch with brigade headquarters so that he can react to the flow of battle. Each successive position must be developed before occupation by the maneuver elements to enable the more complete development of the delay positions. The engineer assets in the corps may be used to begin development at LINE SUZY and LINE WOMBAT before combat assets are available. This would mean that more time may be available for placing obstacles.

(CLASSIFICATION)

DRAFT

Copy _____ of _____ Copies
 25th Armd Div
 LOST CITY (3121)

FL 79

OPORD II

References:Time Zone Used Throughout the Order: ALFATask Organization:1st Bde

3-91 Mech
 3-92 Mech
 3-10 Armor
 3-11 Armor
 3-50 FA (DS)

2d Bde

3-93 Mech
 3-94 Mech
 3-12 Armor
 3-13 Armor
 3-51 FA (DS)

3d Bde

3-95 Mech
 3-14 Armor
 3-15 Armor
 3-52 FA (DS)

312th Sep Bde (Mech)

1-740 Mech
 1-741 Mech
 1-221 Armor
 1-222 Armor
 A/1-312 Cav

Div Arty

3-53 FA
 1-600 FA
 64 FA Gp
 2-631 FA
 2-632 FA
 2-671 FA
 2-672 FA
 2-661 FA

Div Troops

3-22 Cav
 3-440 ADA (C/V)
 25th Avn Co
 287th ASA Co
 (Remains Atch)
 25th MP Co.
 25th Sig
 25th CEWI Co
 25th CML - DEF

DISCOM

25th AG Co
 25th Fin Co
 25th Maint
 25th Med
 25th S&T
 25th Admin Co

(NOTE: No engineers have yet been task organized. This results from your Engineer Staff Estimate.)

(CLASSIFICATION)

(CLASSIFICATION)

1. SITUATION

- a. Enemy Forces: Annex A (Intelligence) (Omitted)
- b. Friendly Forces: (Omitted)
- c. Attachments and Detachments: Task Organization.

2. MISSION

25th Armd Div occupies Line DANCER by 010100 A Apr ____; assists passage of 52d and 54th Inf Div (Mech) to completion at 020130A; delays enemy forward of Line WOMBAT for 39 hours commencing 020130 hrs and reverts to Corps Reserve on completion.

3. EXECUTION

- a. Concept of Operation. Annex B (Operation Overlay)

- (1) Maneuver. Division conducts passage of lines and delaying operation in sector in four phases: (Phase Descriptions Omitted)
- (2) Fires: (Omitted)

Annex C (Fire Support)

- b. 1st Bde

- (1) Occupy IDP, Line Dancer, commencing 311600 A Mar ____.
- (2) Assist passage of 52d Inf Div (Mech).
- (3) Delay enemy forward of Line WOMBAT occupying successive positions Line MOUSE, Line SUZY, on order.

- c. 2d Bde

- (1) Occupy IDP, Line DANCER, commencing 311600 A Mar ____.
- (2) Assist passage of 54th Inf Div (Mech).
- (3) Delay enemy forward of Line WOMBAT occupying successive positions Line MOUSE, Line SUZY, on order.

(CLASSIFICATION)

(CLASSIFICATION)

d. 3d Bde

- (1) Occupy IDP, Line DANCER, commencing 311600 A Mar ____.
- (2) Assist passage of elements of 52d and 54th Inf Divs (Mech).
- (3) Delay enemy forward of Line WOMBAT occupying successive positions, Line MOUSE, Line SYZY on order.

e. 3-22 Cav

Screen forward of IDP, upon withdrawal through IDP, provide rear area security. Assemble in position R00, with 3d Bde as part of Corps Reserve upon passage of Line BOZO.

f. Arty * * * * *g. Engr

- (1) Annex D (Obstacle)
- (2) Annex E (Engineer)

h. DISCOM

- (1) Phase I. Move to vic PILLTOWN (7217)
- (2) Phase II, III, IV. On occupation of Line WOMBAT move, on order, to new position vic BLUETOWN (9521).

i. Res

- (1) 312th Sep Bde (Mech). Annex B (Operation Overlay)
 - (a) Phase I. Move to rear of Line MOUSE in area vic of grid 4711.
 - (b) Phase II, III, IV.

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(CLASSIFICATION)

j. Coordinating Instructions.

- (1) Complete reconnaissance of Line DANCER NLT 310600 A Mar ____.
- (2) All fires west of Line DANCER must be approved by this HQ until notified otherwise.
- (3) Brigades on Line Dancer assist passage of 52d and 54th Inf Div (Mech) have crossed Line DANCER. Detail in demolition target folders.
- (4) * * * * *

4. SERVICE SUPPORT (Omitted)5. COMMAND AND SIGNAL (Omitted)

Acknowledge:

DORR
MGOfficial:
/S/ BURST
Burst
G3

Annexes: A - Intelligence (Omitted)
B - Operation Overlay (Omitted, but see Sketch A Annex 2)
C - Fire Support (Omitted)
D - Obstacle (Omitted)
E - Engineer
F - Service Support (Omitted)
G - Traffic Circulation and Control (Omitted)
H - Communications-Electronics (Omitted)
I - Tactical Cover and Deception (Omitted)

Distribution: A
64th Arty Gp

(CLASSIFICATION)

25TH ARMD DIV OBSTACLE SYSTEM TARGET TABULATOR

SECTOR	TARGET	TYPE OF TARGET	MAN POWER (Sqd hrs)	PLANNED EFFORT IN ONE LOCATION	CODE
1st BDE	<u>PHASE LINE DANCER</u>				
	25-XX-1001	Bridge- <u>Res dml</u>	3	1 Sqd 3 hrs	BR1
	25-XX-1002	Abatis, 300m	9	3 Sqd 3 hrs	AB1
	25-XX-1004	Abatis, 200m	6	2 Sqd 3 hrs	AB3
	25-XX-1005	Point MF (nuisance) 4 KM Sq	4	2 Sqd 2 hrs	MF1
	25-XX-1007	Crater fording site	4	2 Sqd 2 hrs	CR3
	25-XX-1009	Earth filled log cribs (9). Use logs from sawmill stockpile	6	1 Sqd 6 hrs plus 1 FEL, 1 post hole digger, one co inf labor	OB1
	25-XX-1006	Destroy Sawmill	1	1 Sqd 1 hr	FY1
	25-XX-1003	Crater road junction Res dml	5	1 Sqd 5 hrs	CR1
	25-XX-1008	Abatis, 3750 SQ. M.	10	2 Sqd 5 hrs	AB2
	<u>PHASE LINE MOUSE</u>				
	25-XX-1011	Crater track junction	2	1 Sqd 2 hrs	CR2
	25-XX-1013	Bridge	2	1 Sqd 2 hrs	BR8
	25-XX-1014	Bridge- <u>Res dml</u>	3	1 Sqd 3 hrs	BR9
	25-XX-1012	Point MF (nuisance), 1500m x 200m	6	3 Sqd 2 hrs	MF4
1st BDE	25-XX-1015	1200m at ditch-improve existing gully & crater track.		2 Sqd 4 hrs	OB8
	25-XX-1010	Abatis 300m	9	2 Sqd 4 1/2 hrs	AB11
	<u>PHASE LINE SUZE</u>				
	25-XX-1018	Crater track junction	2	1 Sqd 2 hrs	CR6
	25-XX-1019	Crater road at defile <u>Res dml</u>	3	1 Sqd 3 hrs	CR7
	25-XX-1022	Crater road junction	4	1 Sqd 4 hrs	CR10
	25-XX-1023	Crater road junction	3	1 Sqd 3 hrs	CR9
	25-XX-1024	ADM-road defile - <u>Res dml</u>	6	2 Sqd 3 hrs plus ADM SVC TEAM (CORPS)	AD1
	25-XX-1026	Road crater	2	1 Sqd 2 hrs	CR12
	25-XX-1027	Road crater	2	1 Sqd 2 hrs	CR13
	25-XX-1028	Road crater	2	1 Sqd 2 hrs	CR14
	25-XX-1029	Abatis 280m	9	3 Sqd 3 hrs	AB6
	25-XX-1025	Crater road junction Res dml	5	1 Sqd 5 hrs	CR11
	<u>PHASE LINE WOMBAT</u>				
	25-XX-1030	Crater track junction	3	1 Sqd 3 hrs	CR16
	25-XX-1031	Crater track junction	3	1 Sqd 3 hrs	CR17
	25-XX-1035	Crater track junction	4	1 Sqd 4 hrs	CR18
	25-XX-1034	Crater road junction Res dml	5	1 Sqd 5 hrs	CR15
	25-XX-1036	Bridge - <u>Res dml</u>	3	1 Sqd 3 hrs	BR12

25-XX-1037	Point MF (nuisance) 200m x	5	1 Sqd 5 hrs	MF7
25-XX-1039	Abatis - 300m	8	1 Sqd 8 hrs	AB8
25-XX-1038	Bridge	2	1 Sqd 2 hrs	BR14
25-XX-1040	Nuisance MF-1500m x	5	1 Sqd 5 hrs	MF10
25-XX-1042	Crater road junction	4	1 Sqd 4 hrs	CR25
25-XX-1033	Road crater	2	1 Sqd 2 hrs	CR24

2d BDE ** ** ** ** **
 3d BDE ** ** ** ** **

* For locations of the obstacles listed on this addendum see map, page 5-29.

25TH ARMD DIV
ENGINEER WORKLOAD—LESS OBSTACLES

The ADE estimated that the following engineer spt will be needed to assist in the preparation of the delay positions in each bde area. (This is in addition to the work needed for the barrier system.) In addition to the effort shown in the table, the ADE estimated that two plts of the LE Co would be needed from Corps resources.

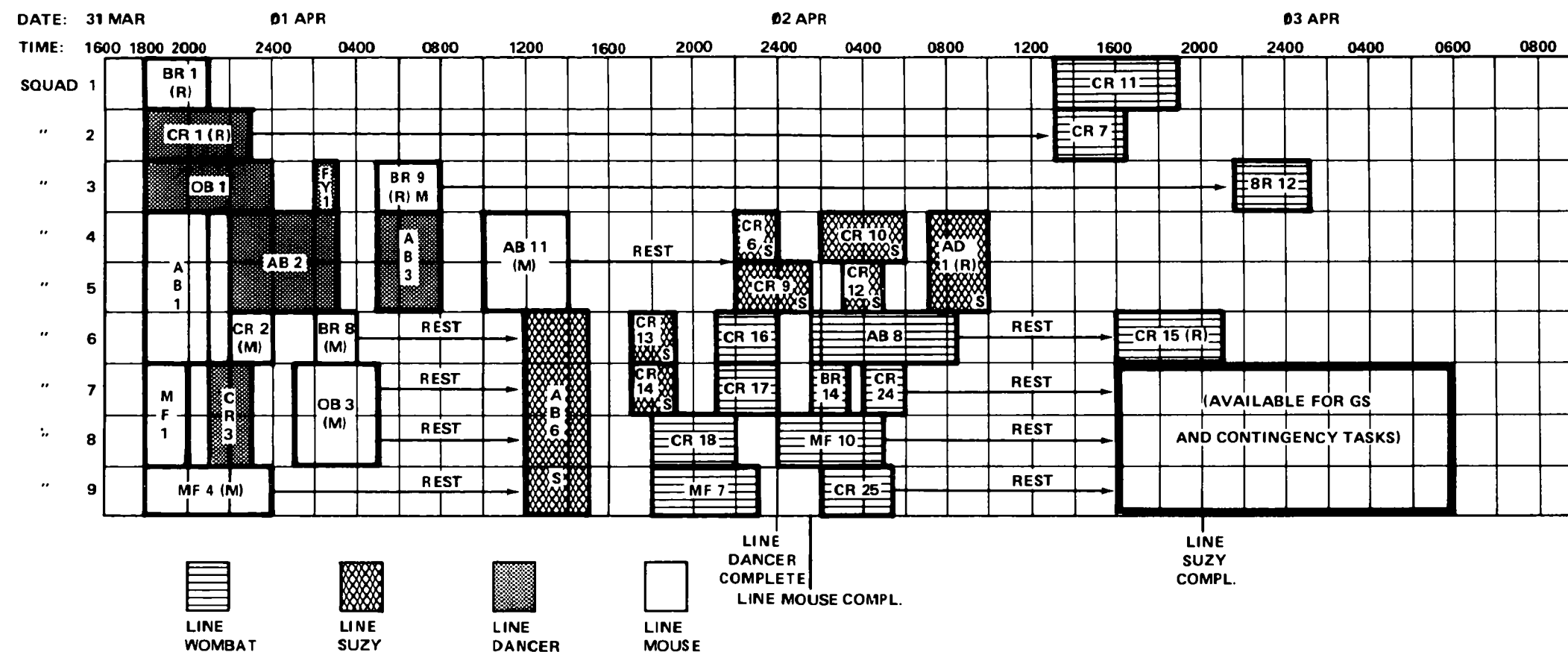
SECTOR	EFFORT REQUIRED	REMARKS
1st BDE	6 squads continuously	
2d BDE	6 squads continuously	
3d BDE	5 squads continuously	
DIV HQ	1. squad continuously	For both main and alternate
DISCOM	Nil	Provided by Corps engrs back in new pos.

The above estimate is based on the amount of work involved in carrying out the following tasks (in the quantities required) at each delay position.

- Prepare helipad(s) for medivac and resup.
- Assist in clearance of obs to facilitate rear movement of tanks/APCs.
- Assist in preparation of arty fire pos, access tracks and ammo pts.
- Assist in
 - Locating and improving hull down firing pos for tanks.
 - Clearing fields of fire.
 - Const MG emplacements.*
 - Const Inf wpn pos.*
- Preparation of Div HQ pos and alternate Div HQ pos.
- Be prepared to clear lanes through scatterable minefields if employed by enemy.
- Be prepared to install assault bridging if required.
- Be prepared to facilitate crossing/bypassing of road craters.
- Seed all arty fire pos, helipads, CP locs, etc., with nuisance mines before abandoning.

*If time permits.

TASK TABLE
ENGINEER SUPPORT OF THE DIVISION RETROGRADE
(OBSTACLE WORK ONLY)



SECRET
(For training only)

ANNEX E (Engr) to OPORD II - 25th Armd Div

References: OPORD II - 25th Armd Div
Time Zone Used Throughout the Order: ALFA

Task Organization: OPORD II

1. SITUATION

- a. Enemy Forces. Annex A - Intelligence
- b. Friendly Forces. OPORD II
- c. Attachments and Detachments. Task Organization - OPORD II

2. MISSION

Engineers support division delay from Line Dancer to Line WOMBAT commencing 311600 A March ____.

3. EXECUTION

a. Concept of Operations. 25 Engr Bn, reinforced with 5095th Engr Co and corps engr elms, spr div delay by atch reinforced companies to 1st, 2d, 3d Bde. Tasks include obstacles, delay positions and support in bde sectors. 25 Engr Bn (-) plus atch units provide GS.

b. 23 Engr Bn

- (1) Receive atch IAW Task Organization.
- (2) Provide atch IAW Task Organization.
- (3) Release 5095th Engr Co to revert 312th Sep Bde O/O.
- (4) Barrier const IAW Annex D.
- (5) Delay positions coordinated with bdes. Other tasks IAW Appendix 1 (Task List).

c. 5095 Engr Co

- (1) Atch 25 Engr Bn.
- (2) O/O revert to parent unit.

d. Two plt/B/502d Engr Bn (Cbt). Atch to C/25 Engr.

e. Two plt/B/5080th Engr Co (LE). Atch to 25 Engr Bn.

SECRET
(For training only)

SECRET
(For training only)
Example only

f. 5520th Engr Plt (ADM). Atch to A/25 Engr.

g. Coordinating Constructions.

- (1) Task org eff 311600 A Mar ____.
- (2) Movement and reconnaissance timings IAW OPORD II.
- (3) Work commences Line DANCER 311600 A.

(a) DANCER - 012400 A Apr

(b) MOUSE - 020130 A Apr

(c) SUZY - 021930 A Apr

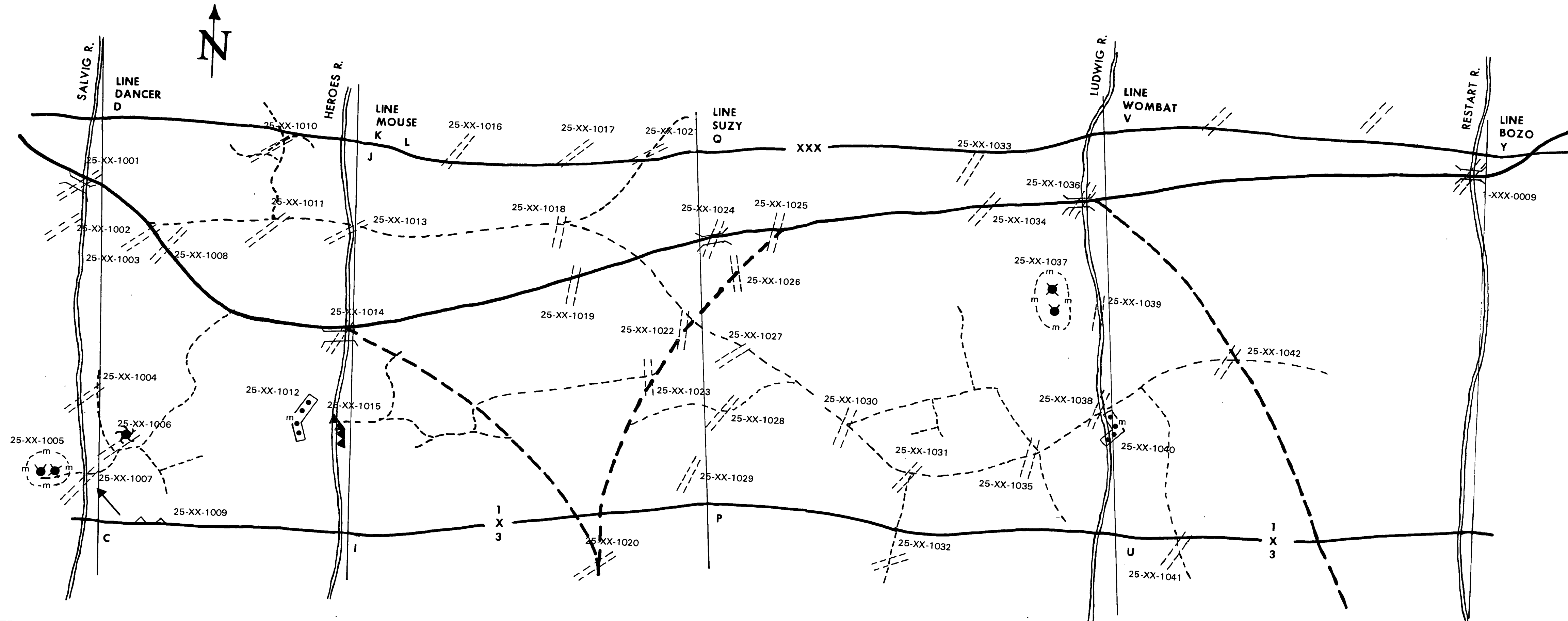
(d) WOMBAT - 030430 A Apr

4. SERVICE SUPPORT. OPORD II.

5. COMMAND AND SIGNAL. OPORD II

Appendix: 1 - Engr Task List (Omitted)

SECRET
(For training only)
Example only



FUTURE DEVELOPMENTS

This chapter discusses *engineer materiel developments* which will be fielded after 1978 and *emerging doctrine and concepts* which will significantly affect engineer organization and employment in future years.

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Section I

MATERIEL DEVELOPMENTS

Battlefield technology is improving constantly. The evolution of new equipment is often the driving force for new tactics and operations. Battles have been lost and armies defeated because soldiers and generals were not attuned to new developments of the enemy or they misused and/or mistrusted their own new developments. It is axiomatic that our emerging materiel developments should be widely disseminated to, and understood by, soldiers at all levels.

Engineers at all levels must be aware of new materiel developments.

MOBILITY

This section highlights some of the new equipment expected to be in the field in 1979 and beyond which will significantly affect the engineer mobility, countermobility, survivability, and general engineering missions.

There has been and continues to be a pronounced organizational trend toward increasing the percentage of mobile armored and mechanized forces in the US Army.

Engineer mobility developments must keep pace with the increased mechanization of our forces.

This increased potential for mobility will not be realized unless there is a commensurate increase in engineer mobility enhancement capabilities.

The engineer materiel development program is geared to meeting this challenge. Some of the more significant developments to improve the engineer system capabilities to facilitate mobility are discussed briefly in this section.

COUNTERMINE

Mine Detection

Vehicle Mounted On-Road Mine Detector (VMRMD)

Concept of Use: Used on LOCs in the rear areas to detect buried AT mines. It consists of a search head mounted in front of a vehicle.

Capabilities: Capable of searching ahead of a vehicle traveling up to 10 kmph, detecting both metallic and nonmetallic AT mines buried up to 12 inches.

Expected Field Date: 1980

Airborne Mine Detection System (AMIDS)

Concept of Use: Mounted in a helicopter or a remotely controlled vehicle and used to produce real time battlefield intelligence; by scanning with radar areas ahead of friendly forces, the AMIDS will provide early warning of minefields.

Capabilities: Will detect locations of surface laid minefields out to ranges of 500 meters or more.

Expected Field Date: 1984 or beyond.

Mine Neutralization

Surface Launched Unit Fuel Air Explosive (SLUFAE)

Concept of Use: Rocket propelled fuel air explosive used for assault breach of minefields from standoff (300-1000m) positions.

Capabilities: Creates explosive overpressures to detonate and/or displace mines. Sequential firing of 30 rockets will clear a lane at least 8 meters wide and 200 meters long.

Expected Field Date: 1981

Vehicle Magnetic Signature Duplicator (VEMASID or MASK)

Concept of Use: A magnetic duplicating system mounted on an armored vehicle to prematurely activate magnetically fused mines.

Capabilities: Will activate magnetically fused mines in a sufficiently wide path and far enough in front of a vehicle to preclude damage.

Expected Date System will be Fielded: 1982

COMBAT BRIDGING

System of Bridging for 1985 and Beyond

Concept of Use: A trinational (England, Germany, and US) development to provide replacement bridging for 1985 and beyond. Assault, dry gap support, and wet gap support are included.

Capabilities: Assault bridge will be 25 to 30 meters long, launched from a standard tank chassis in 3 to 5 minutes. Dry support bridge will be launched from a wheeled launcher, cross class 60 loads over spans of 30-40 meters and have piers and cable

reinforcing kits to extend span capability. Wet support bridge will be capable of both bridging and rafting operations quickly emplaced (120 meters in 20-30 minutes). Dry and wet support bridge will use a common launcher.

Expected Field Date:

Assault:	1992
Dry Support:	1988
Wet Support:	1990

OBSTACLE REDUCTION/TERRAIN ENHANCEMENT

Universal Engineer Tractor (UET)

Concept of Use: The principal use is in earthmoving mode. Major tasks will be preparation of battle positions, strongpoints, artillery positions, command posts, and clearing or maintaining routes of movement. The UET is a responsive recovery vehicle and is also used to haul equipment and obstacle materials (can haul troops, if required). It is highly mobile, swims and is survivable under combat conditions.

Expected Field Date: 1980

COUNTERMOBILITY

The Threat forces rest their land combat power upon the tank.

Engineer material developments in the countermobility field focus on the tank threat and are keyed on improving mine systems and obstacle construction capabilities.

***To Win the
Next War
the Tank Must
Be Stopped***

To stop the tank, the combined arms team depends on the engineers performing their countermobility function.

MINES

The most effective means today and in the foreseeable future of achieving countermobility is by reinforcing the terrain through the use of mines. Mines will gain importance in the next decade as new developments in the rapidly emplaced scatterable mines come into the inventory.

Family of Scatterable Mines (FASCAM)

Artillery Delivered Antitank Mine (ADATM)

Concept of Use: Fired by the 155mm howitzer the magnetic influence fuzed AT mine will have two self-destruction time options. They are placed on or in front of enemy columns to block avenues of approach, seal flanks, close gaps or hinder

withdrawals. The engineer is involved in staff planning and integration of the system into the obstacle plan.

Capabilities: 12 rounds can emplace a minefield 250m x 350m.

Expected Field Date: 1980

Ground Emplaced Mine Scattering System (GEMSS)

Concept of Use: It consists of magnetic influence fuzed AT mines and tripwire activated blast type AP mines. The dispenser is trailer mounted and provides variable mine mix and density options. The mines have a long self-destruct setting with one optional field setting.

Capabilities: Dispensing rate is 1,600 mines per hour. A 1,000m by 60m minefield can be emplaced in about 30 minutes.

Expected Field Date: 1981

Modular Pack Mine System (MOPMS)

Concept of Use: It is a prepackaged assortment of APers or AT mines which are command deployable. If not deployed, the package may be picked up and moved with units. Though primarily used by combat units for hasty protective minefields they will be used to close lanes and gaps and mine other obstacles. The mines have a self destruct feature after deployment.

Capabilities: MOPMS will distribute mines over a 180 degree fan in an area 70m x 35m.

Expected Field Date: 1982

Surface Launched Unit Mine (SLUMINE)

Concept of Use: A rocket propelled mine dispensing system with a standoff capability of 300m to 5km. Mines have a self-destruct capability and will use the same launcher as the SLUFAE.

Capabilities: Will emplace a minefield of 1,200m x 300m at ranges of up to 5km.

Expected Field Date: 1983

OBSTACLE CONSTRUCTION

Universal Engineer Tractor (UET)

Family of Military Demolitions (FAMDEMS)

Universal Engineer Tractor (UET)

Concept of Use: It will play a major role in those obstacle construction tasks which involve dozing, ditching, or earthmoving operations. It can also be used to haul mines and other obstacle materials from prestock points in the brigade area to forward work sites.

Family of Military Demolitions (FAMDEMS)

A systems approach to explosives and demolition devices which improves the total systems management of demolition doctrine, materiel and training.

The FAMDEMS materiel development which will have the greatest impact on countermobility operations is BULK EXPLOSIVES.

Bulk Explosive System

Concept of Use: It is a wheel-mounted mixer/pump unit (may be a standard concrete mixer) which will mix two or more inert materials to form the bulk explosives. Principal uses will be for large antiarmor obstacles, quick loading of pre-chambered targets, and in construction operations where a large amount of demolitions is required.

Capabilities: The equipment will mix 5,000 lb of explosive in 15 minutes. The inert ingredient will be stored as Class IV supply.

Expected Field Date: 1980

SURVIVABILITY

Artillery caused more than half of the casualties during World War II. The modern battlefield is characterized by massed artillery. The Threat makes extensive use of artillery. To survive this artillery and other modern weapons, our soldiers and their weapon systems must be dug in and positions protected. The combined arms team looks to the engineer for the expertise and equipment

to provide the survivability. Techniques utilizing combinations of earthmoving means such as rippers, backhoes, augers, handtools, and explosive charges will continue to provide immediate support on the battlefield.

Our development effort is directed to meeting this need. Faster, more efficient, mobile, flexible, and protected earthmoving equipment is needed in the forward areas. Improved, innovative, and rapidly emplaced overhead protection is needed to withstand the effects of enemy weapons.

EARTHMOVING EQUIPMENT

UET

Rapid Excavation Equipment

UET

Concept of Use: The UET will be the primary earthmoving item of equipment in the forward area. It is ideally suited for the task of slot construction of protective positions for large weapon systems. The self-loading characteristics of the UET permit rapid removal of spoil which heretofore has greatly complicated surveillance efforts. The armor protection and overall survivability of the UET provide a capability of preparing protected positions under combat conditions.

Rapid Excavation Equipment

Concept of Use: Efforts are currently underway to identify and exploit rapid excavation equipment utilized by civilian construction or military organizations throughout the world. Long range developmental efforts are focused on the need for rapid excavation equipment that can be utilized under combat conditions to construct strongpoints and other subsurface protective positions.

Expected Field Date: Unknown

PROTECTIVE SHELTERS

Concept of Use: They will be lightweight, quick and easy to emplace and able to be recovered and moved to subsequent locations. It is envisioned that they will be of frame/fabric construction reinforced by

earth cover. Shelters will be developed for individual as well as activity use.

Capabilities: Provide protection against fragmentation of a near miss (10 meters) of a 152mm round (contact or VT fuse).

Expected Field Date: 1979

GENERAL ENGINEERING

To sustain combat operations, the forward fighting elements are dependent upon a line of communications network ranging from combat trails to high-speed roadways rearward from the division area. New enemy capabilities require greater performance of protective positions in our rear areas. Development of headquarters areas, base camps and supply/maintenance points will be on a more reduced scale than experienced historically but will be required for efficient rear area support. Terrain is the common denominator on the battlefield and commanders must have responsive and reliable terrain information.

Engineer development activities are directed at improving the capability to accomplish *general engineering missions*.

EARTHMOVING EQUIPMENT

Commercial Construction Equipment (CCE)

UET

Family of Military Engineer Construction Equipment (FAMECE)

Commercial Construction Equipment (CCE)

Concept of Use: The program provides for the modernization of construction equipment by taking advantage of the construction equipment industry's highly competitive research and development efforts.

Capabilities: At present there are 41 items of equipment on the CCE priority list. The performance characteristics will match or exceed current items of military construction equipment.

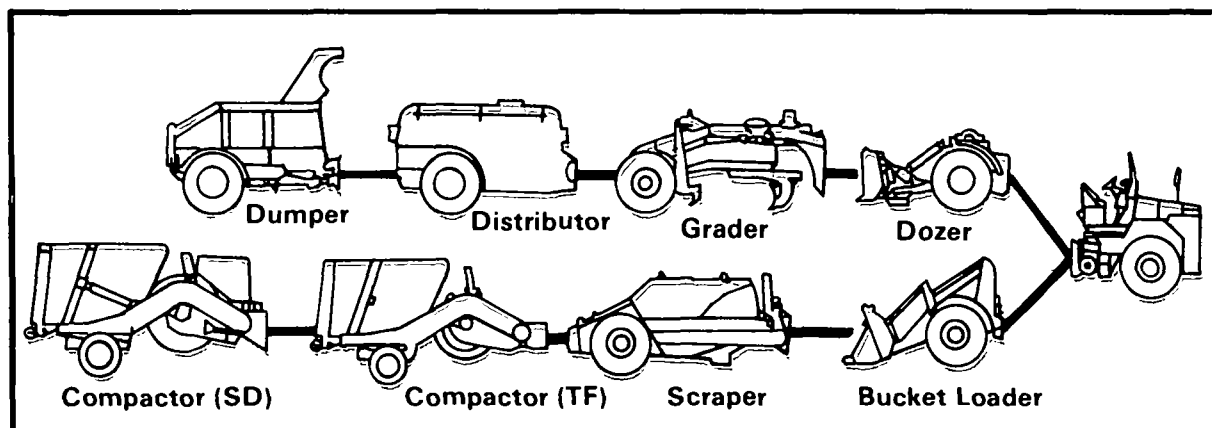
Expected Field Date: As various items are accepted.

UET

Concept of Use: The UET will be issued to corps engineer units which will accomplish general engineering missions in the division and corps areas.

Family of Military Engineer Construction Equipment (FAMECE)

Concept of Use: FAMECE is a family of eight air transportable/air droppable construction vehicles consisting of a scraper, a grader, a dozer, a loader, a dumper, a water distributor, a pneumatic-tire/tamping-foot compactor and a pneumatic-tire/steel drum compactor. Each consists of a standard power section and a work section. Will be used primarily by airborne/airmobile units and will replace 20 current makes and models of construction equipment.



Capabilities:

Scraper: 10 cubic yards struck, self-loading.

Grader: 13 ft. blade; 20,000 lb drawbar pull.

Dozer: Semi-U blade; 80 loose cubic yards per hr slot dozing.

Loader: 2 1/2 cubic yard bucket; 250 loose cubic yards per hr.

Dumper: 10 tons off road capability.

Distributor: 2,500 gallons; self-loading.

Compactor: Pneumatic-tire/tamping foot; 8 cubic yards ballast.

Compactor: Pneumatic-tire/steel drum; 8 cubic yards ballast; vibration.

Expected Field Date: 1981

WATER SUPPLY

Reverse Osmosis Equipment

Concept of Use. Family provides water purification to produce potable water from fresh, brackish and salt water sources. The 600 GPH unit is air transportable and air dropable and will be issued to airborne and airmobile units. The 3000 GPH unit is air transportable.

Capabilities: The equipment will have water production capabilities of 600 and 3000 gallons per hour for fresh and brackish water sources and a reduced capability for salt water sources.

Expected Field Date:

600 GPH - 1980

3000 GPH - 1986

POWER GENERATION

Concept of Use. A family of silent lightweight electrical energy plants (SLEEP) which range from 1.5 to 10 kw is under development. The 1.5 units use a methanol fuel cell and will be difficult to detect by visual, aural, and IR means. The 1.5 kw generator will be issued to forward area units where noise discipline is essential to the performance of its tactical mission.

Capabilities: The power output of the power plant shall be either 28 Volt DC or 120/240 Volt, 60 Hz.

Expected Field Date:

1.5 kw - 1982

Others - Unknown

TERRAIN INFORMATION

Topographic Support System (TSS)

Army Terrain Information System (ARTINS)

Topographic Support System (TSS)

Concepts of Use: TSS is a complete set of new topographic equipment which will provide a field capability to produce map products within 48 hours. These fast response products will enable users to rapidly determine militarily significant factors such as lines-of-sight, areas of defilade, fields of fire, slope, characteristics of lines of communications, cover, concealment, and several others.

Capabilities: TSS will utilize all input data in its original form to provide rapid response products such as indexed photomosaics, uncontrolled and controlled photomosaics, and annotated photo and orthophotomats, revised or annotated maps or oral advice. Successive stages of terrain information will be evaluated to provide high resolution terrain analysis.

Expected Field Date: Some TSS equipment has already been fielded. Full issue by 1983 is projected.

Army Terrain Information System (ARTINS)

Concept of Use: ARTINS will be an automated data system for terrain analysis. This system will interface with tactical systems to provide real time support. The ARTINS computer center will be located with the Army Engineer terrain teams. At corps and division, the terrain teams will be provided with a terminal.

Capabilities: ARTINS will provide predictions of the effects of terrain in the area of operations, to include cross-country movement, line-of-sight denial planning and LOCs, and will provide digital terrain data to several tactical systems.

Expected Field Date: 1980's

Section II

EMERGING

MINE WARFARE

DOCTRINE

The engineer system must adapt to the changing battlefield environment. It is time to re-evaluate the traditional techniques, doctrine, and organization. We must reemphasize that which continues to contribute, discard the outmoded, and adopt the necessary changes which enable the engineers to increase their contribution to the combined arms team.

Some changes in the engineer system are evolving and will be considered in this section.

MINE WARFARE

For the past some thirty years, mine warfare has been an object more of discussion than of practice within the combined arms teams. Progress was made during this period, but recognized constraints of time, manpower, and logistics necessary for the use of mines and their defeat have caused commanders to place a low priority on mine warfare. The recent wars in the Mideast have shown conclusively that past practices must change. The use of mines and a capability to defeat them are essential for success on the modern battlefield.

This emerging recognition of the importance of mine warfare has coincided with several materiel developments which remove many of the constraints which historically have relegated warfare to a lesser stature. Scatterable mines and rocket delivered fuel air explosives are two such developments. Changing concepts in organizations and operational techniques will capitalize on these and other developments.

Scatterable mines open up new opportunities for responsive and flexible terrain reinforcement. Appendix L "Evolving Concepts in Mine Doctrine" provides an insight on how these new mine systems may be assimilated into the engineer system.

Mine rollers, rocket propelled line charges, and SLUFAE provide increased countermine capabilities but organizational changes are needed to insure that these items are integrated into the engineer system at the appropriate place to provide effective and timely response to the combined arms team. The emphasis must be forward. Changes to existing TOEs are under study.

Threat doctrine, which includes the use of rollers, plows, and explosive charges to breach minefields, makes some of our current time and labor intensive minefield patterns outmoded. Our use of mechanical mine planters and the surface employment of conventional mines should change the Threat force composition and its countermine tactics. Simple, rapidly emplaced minefields are effective and appropriate.



Appendix A

US COMBAT

ENGINEER

EQUIPMENT

This appendix contains selected equipment found in division engineer battalions.

Contents

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M728 COMBAT ENGINEER VEHICLE

1) Technical characteristics:

Weight - 57.5 tons

Class - 57

Length - 31'

Width - 12' 2"

Height - 10' 8"

Crew - 4 men

Main armament - 165mm demolition gun

Ammunition - 165mm HEP

Maximum effective range - 950m

Secondary armament - 1.50 cal MG and
1-7.62 MG

Maximum speed - 30 mph

Cruising range - 280 miles

Ditch crossing capability - 8' 3"

Vertical obstacle climbing capability -
2' 6"

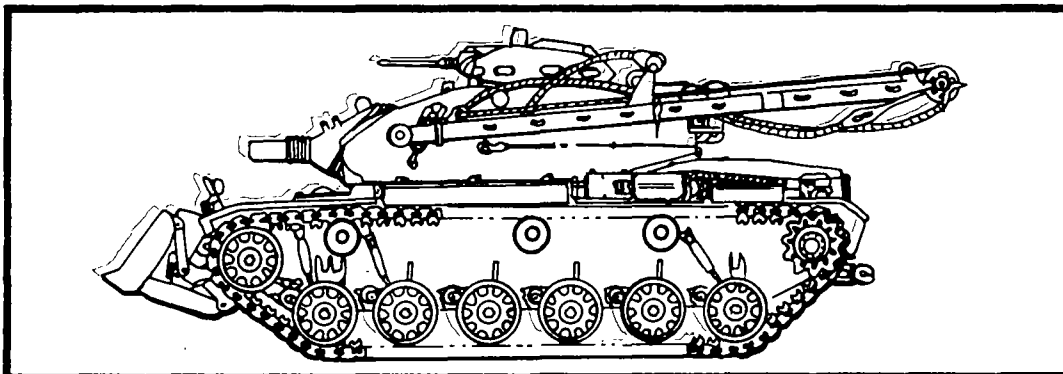
Fording capability - 3' 6"

Winch and A-frame lifting capability -
17,500 pounds

Dozer blade width - 12' 2"

2) Role: The CEV's primary role is that of an assault gun used to destroy bunkers and other fortified positions. In addition the dozer blade and A-frame can be used in the preparation of defensive positions and other general engineer work.

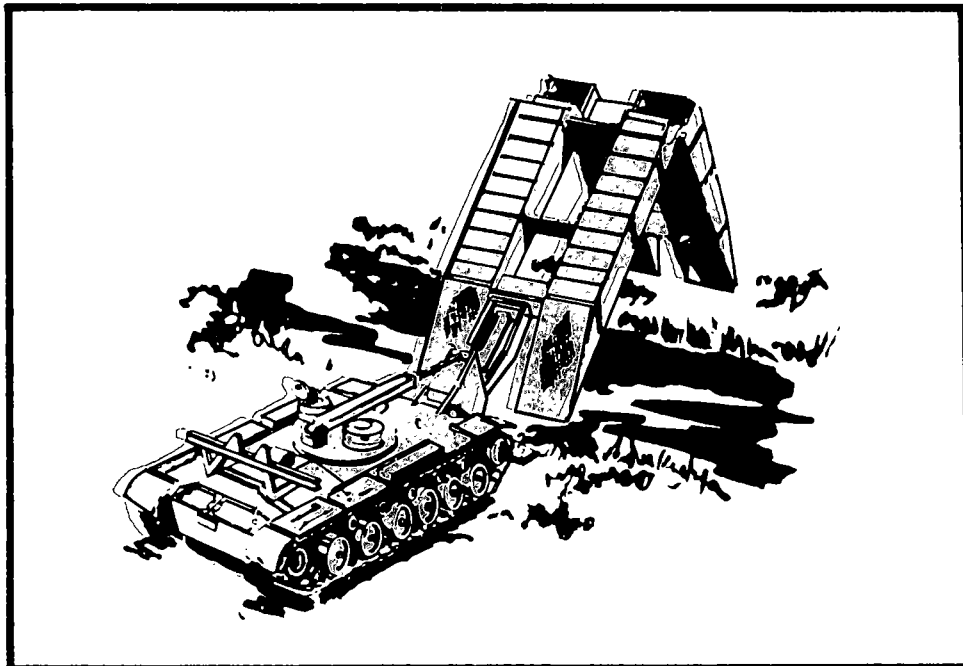
3) Remarks: The CEV is not a tank and should not be employed as a tank. A CEV using the dozer blade does not have the earthmoving capability of a D-7. However, it is effective in clearing rubble and obstructions and for slot dozing protective positions.



1) Technical characteristics:**Launcher and bridge***Weight - 57.8 tons**Class - 57**Length - 36' 7"**Width - 13' 2"**Height - 16' 8"***Launcher***Weight - 42 tons**Length - 28' 4"**Width - 10'**Height - 9' 4"**Crew - 2 man**Maximum speed - 30 mph**Cruising range - 310**Launcher ditch crossing capability - 8' 6"**Vertical obstacle climbing capability - 3'**Fording capability - 4'**Bridging capability - 60' on concrete abutments; 57' on unprepared abutments.***ARMORED
VEHICLE
LAUNCHED
BRIDGE**

2) Role: Provide assault bridging capability for supported units.

3) Remarks: When using the AVLB at the maximum span length, a guide must be used to position the launcher.



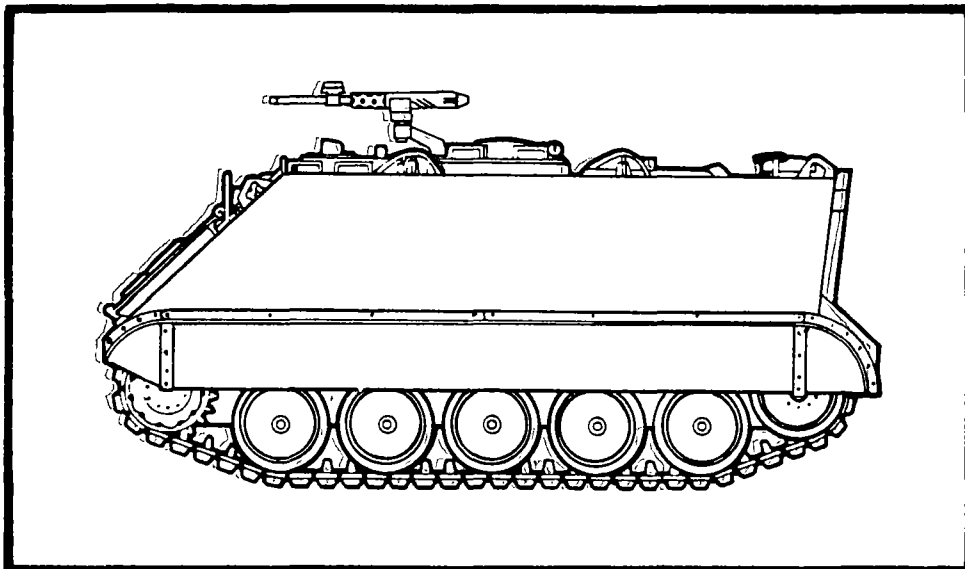
**M113A1
ARMORED
PERSONNEL
CARRIER**

1) Technical characteristics:

Weight - 12.1 tons
Class - 11
Length - 16'
Width - 8' 10"
Height - 7' 2"
Crew - 1 man
Armament - 1.50 cal MG
Maximum speed - 40 mph
Cruising range - 300 miles
Ditch crossing capability - 5' 6"
Vertical obstacle climbing capability - 2'
Swimming speed - 5.3 ft/sec
Draft required - 5'
Maximum stream velocity - 5 ft/sec

2) Role: Squad vehicle in mechanized and armor engineer units.

3) Remarks: Each APC pulls a 1 1/2 ton trailer containing squad equipment and supplies.



1) Technical characteristics:

Weight - 22,700 lbs

Class - 16

Length - 23' 6"

Width - 8' 2"

Height - 9' 3"

Load capacity - 20,000 lbs, 10,000 lbs
cross-country

Maximum road speed - 50 mph

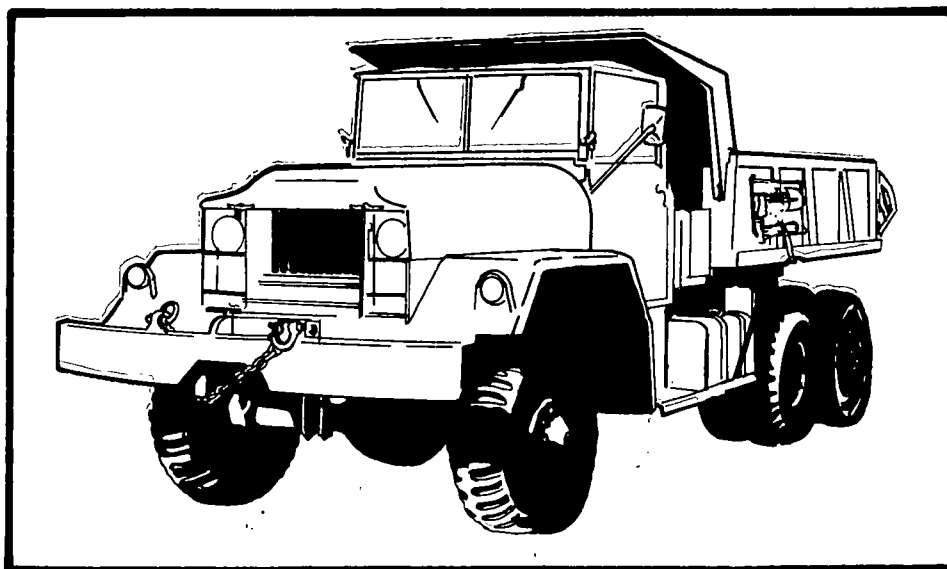
Fording depth - 30", 78" with fording kit

Winch capacity - 20,000 lbs

**M51A2
5 TON
DUMP
TRUCK**

2) Role: Provide earth and cargo hauling capability for the engineer company. Squad vehicle in infantry engineer units.

3) Remarks: The dump truck has cross-country capability, but does not have mobility equivalent to tracked vehicles.



2 1 / 2 CUBIC YARD SCOOP LOADER

1) Technical characteristics:

Weight - 12 tons

Class - 20

Length - 25'

Width - 8' 6"

Height - 8' 7" + roll cage = 12'

Bucket width - 102"

Bucket capacity - 2 1/2 cubic yards

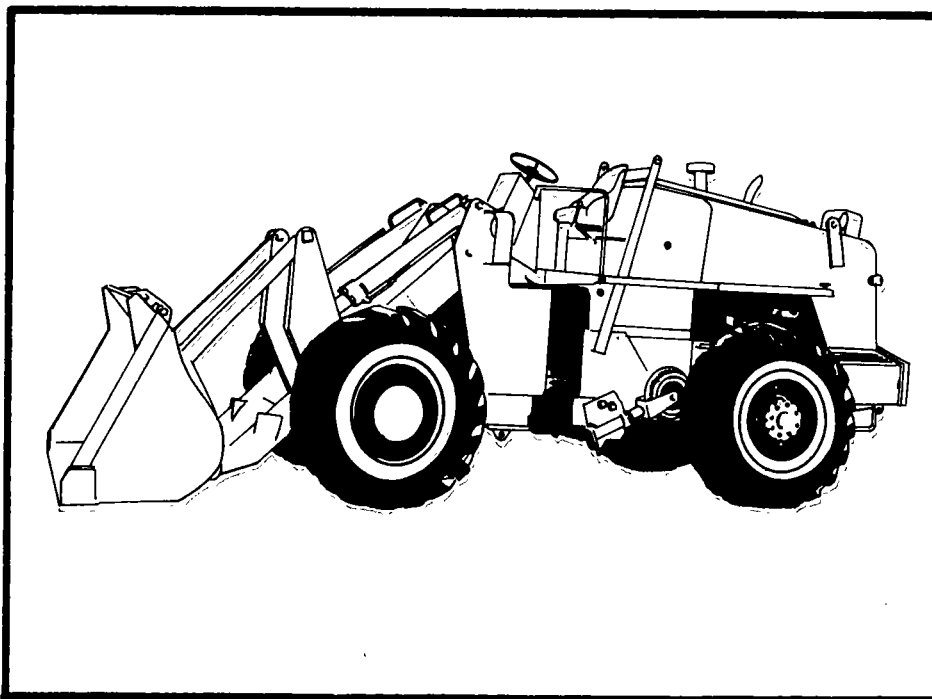
Bucket lifting capability - 15,000 lbs to 8' 2"

Height of bucket fully extended - 12' 1"

Digging depth - 17"

2) Role: The scooploader is capable of dozing, scooping, and loading, providing an earthmoving capability for line companies.

3) Remarks: The scooploader has cross-country capability but does not have mobility equivalent to tracked vehicles.



1) Technical characteristics:

Weight - 24.1 tons

Class - 28

Length - 17' 6"

Width - 11' 5"

Height - 8'

Blade height - 3' 10"

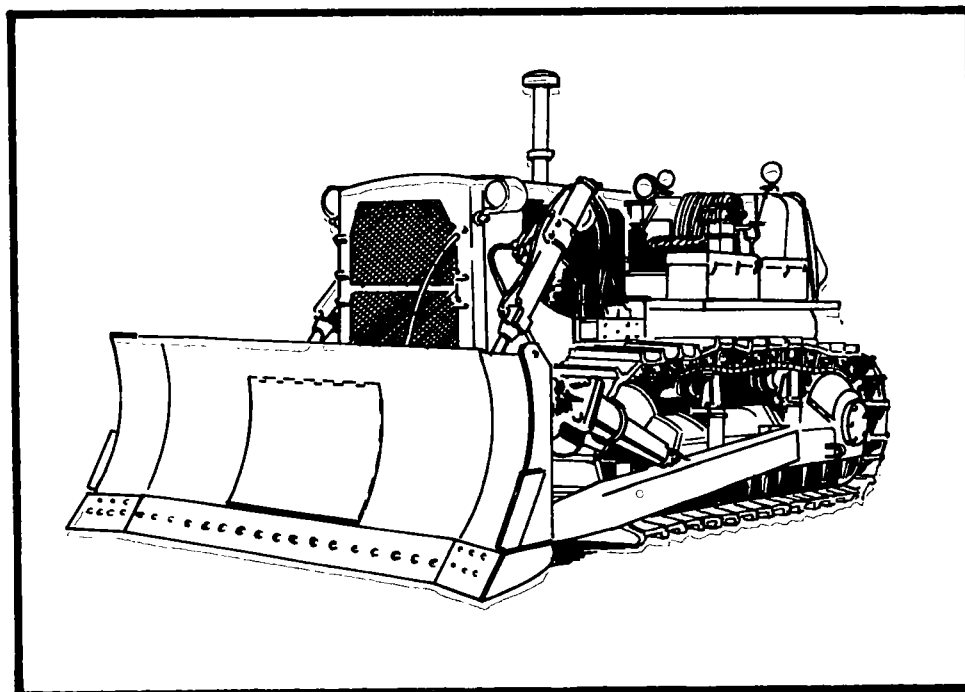
Maximum lift of blade - 3' 8"

Maximum speed - 6.2 mph

Winch capacity - 20,000 lbs.

**D7F
DOZER****2) Role:** Provide earthmoving capability.

3) Remarks: The D-7 requires a 10-ton tractor and semitrailer to move it about.



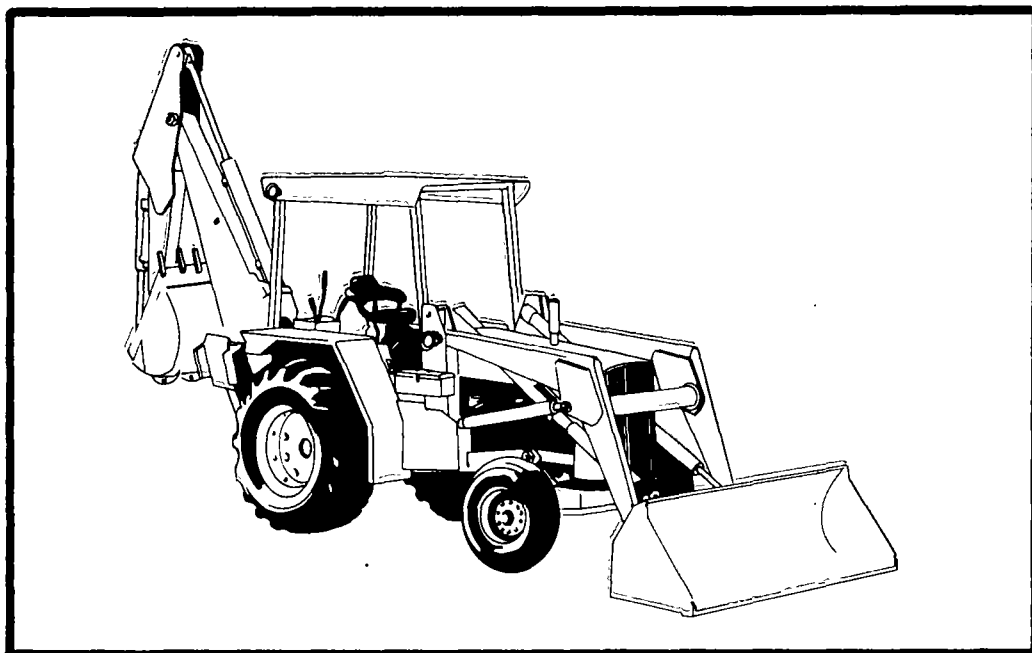
**CCE TRACTOR,
WHEELED
WITH
BACKHOE
AND
LOADER**

1) Technical characteristics:

Weight - 15,000 lbs
Class - 8
Length - 23' 10" for transport
Width - 8' 1" for transport
Height - 8' 6"
Maximum speed - 17 mph
Loader bucket capacity - 1 1/4 cu yds
Loader bucket lifting capacity - 5,000 lbs
Backhoe bucket width - 2'
Maximum backhoe digging depth - 15' 1"
Maximum backhoe reach - 18' 5"
Backhoe bucket capacity - 7 1/2 cu ft
Maximum backhoe loading height - 11' 6"
Maximum backhoe output - 37 cu ft/min
Attachments - impact tool, earth auger
Earth auger capability - 10" diam hole 6' deep

2) Role: Provide rapid entrenching capability.

3) Remarks: The backhoe is an item of commercial construction equipment and will be replaced by the rapid excavation system when developed. The slow maximum speed is a problem to mobility.



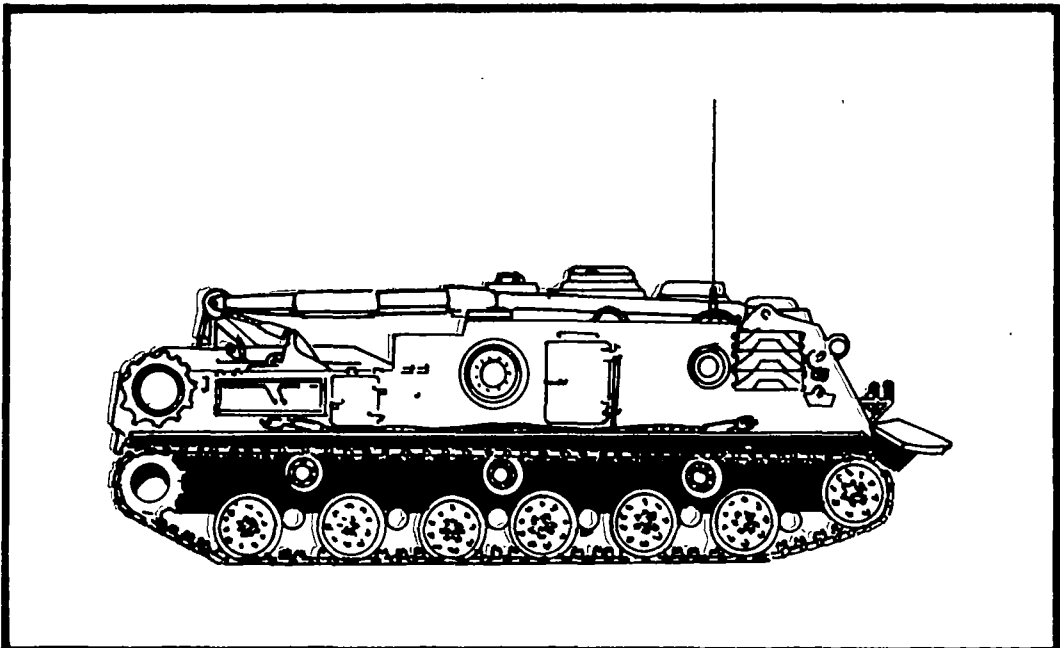
1) Technical characteristics:

Weight - 55 tons
Class - 55
Length - 27' 1"
Width - 10' 3"
Height - 11' 3" in travel position
Crew - 4 men
Maximum speed - 31 mph
Cruising range - 222 miles
Ditch crossing capability - 8' 7"
Vertical obstacle capability - 3' 6"
Fording capability - 5' 4", 8' 6" w/kit
Boom capacity 4 part line -
 spade up - 6 tons
 spade down - 50 tons
Boom lift height -
 with 8' reach - 19'
 with 4' reach - 25'
Main winch capacity - 90,000 lbs
 low speed and bare drum

**M88
RECOVERY
VEHICLE**

2) Role: The M-88 is a medium recovery vehicle.

3) Remarks: The spade on the M-88 is to be used only to stabilize the vehicle in recovery operations and not for dozing.



**M57
ANTITANK
MINE
DISPENSER
SYSTEM**

1) Technical characteristics:

Weight - 3,450 lbs

Class - 2

Length - 163"

Width - 80"

Mine placement rate - 385 mines/hour

Rate of movement:

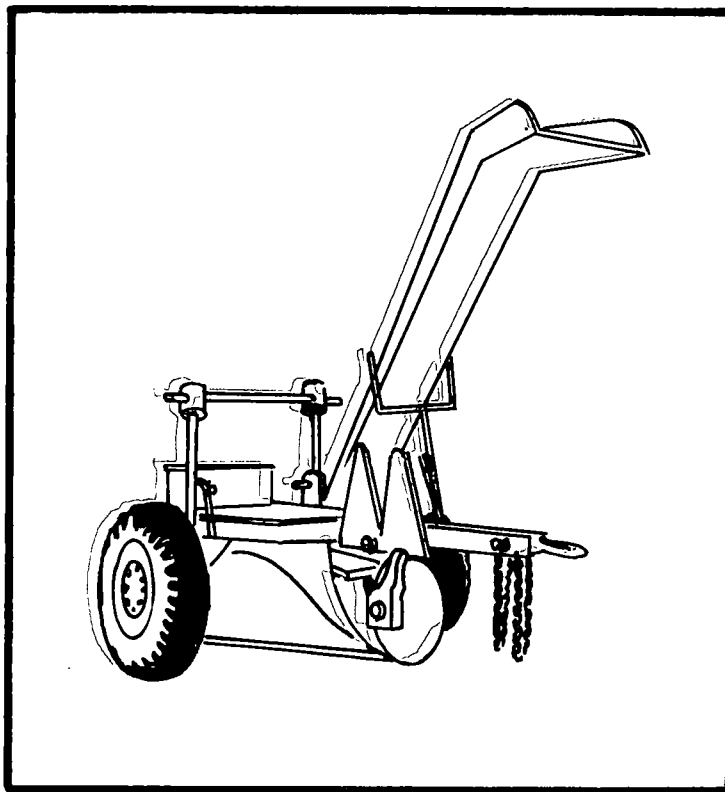
road - 35 mph

cross country - 5 mph

laying mines - 1-3 mph

2) Role: Rapid mechanical emplacement of M15 antitank mines.

3) Remarks: (1) The M57 will place mines in soil up to a California Bearing Ratio (CBR) of 12. (2) A crew of one platoon is required to support the M57 when laying a minefield. (3) The M57 will be replaced by GEMSS in the 1980s. Assigned to units in Europe only.



1) Technical characteristics:

Weight - 56,530 lbs

Class - 30

Length - 43' 6" with 30' boom

Length - 27' 9" without boom

Width - 10' 8"

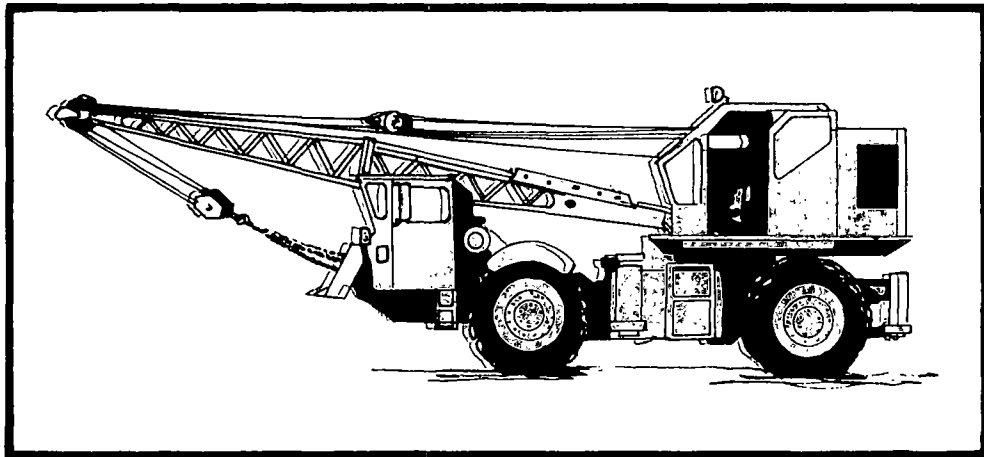
Height - 12' 20" with 30' boom in travel position

Maximum lift - 20 tons at 10' radius

**CRANE,
WHEEL
MOUNTED:
20 TON**

2) Role: Provide lifting and loading capability.

3) Remarks: The following attachments can be used: hook block, dragline, clam, and pile driver. The RT crane is less stable than a truck-mounted crane.



**GRADER,
ROAD,
MOTORIZED**

1) Technical characteristics:

Weight - 27,800 lbs

Class - 10

Length - 26' 10"

Width - 8'

Height - 7' 11"

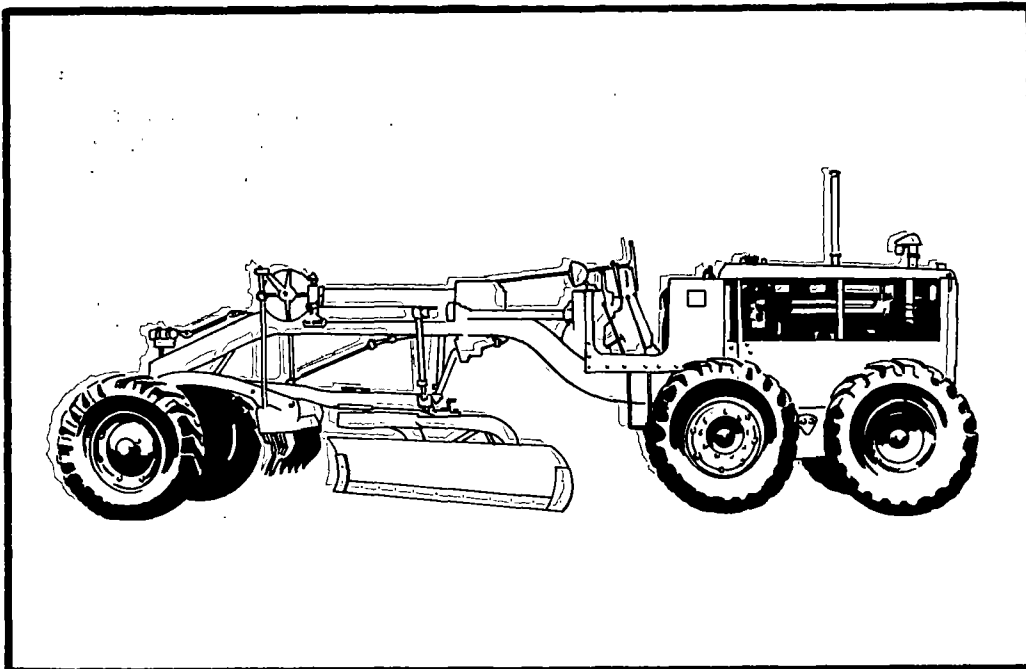
Blade width - 12'

Scarifier width - 3' 10"

Scarifier depth - 9"

2) Role: Provide course and fine grading, ditching, mixing, spreading, scarifying, and bank sloping.

3) Remarks: All engineer battalions in corps and divisional units have graders.



1) Technical characteristics:

Weight - 19,000 lbs

Class - 8

Length - 23' 4"

Width - 8' 2"

Height - 10' 11"

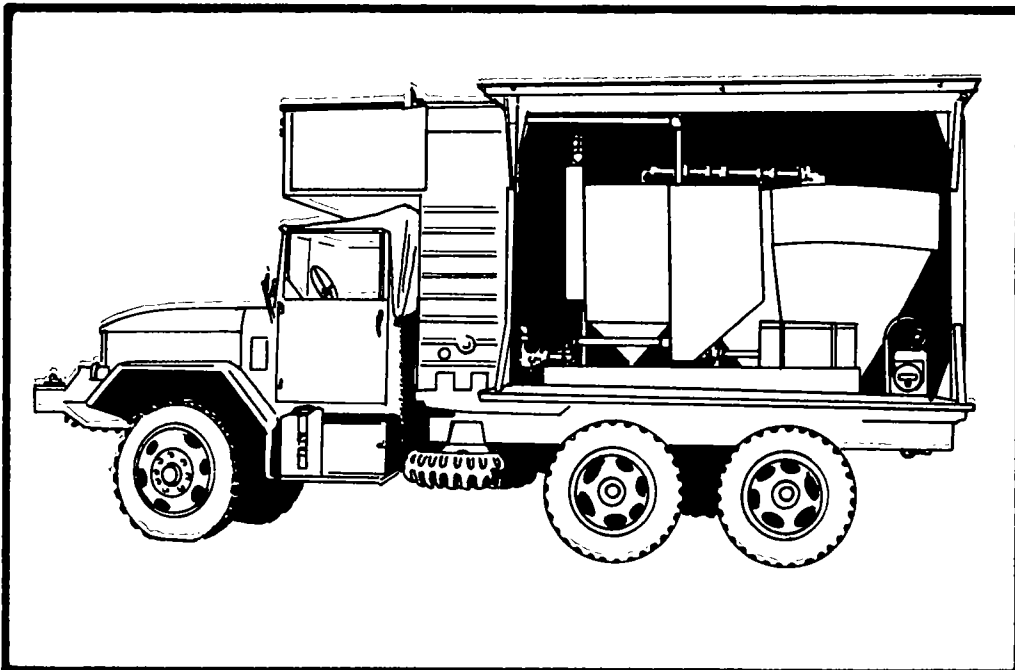
Water production - 1,500 gallons/hour

Power supply - Trailer-mounted 10 KW generator

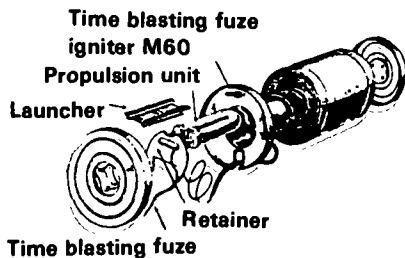
**WATER
PURIFICATION
SET**

2) Role: Division water purification equipment.

3) Remarks: Additional equipment is required when the water is salty, brackish, or CBR contaminated.



M1E1 PROJECTOR CHARGE DEMOLITION KIT



1) Technical characteristics:

Weight (crated) - 142 lbs
Weight (explosive line) - 63 lbs
Breaching path - 2.44m wide and 52m long (8' x 70')
Components - Nylon-covered detonating cord, propulsion unit, launcher, anchor stake, fuze igniter, delay detonator and carrying case

2) Role: To clear a foot path through anti-personnel minefields.

3) Remarks: Two men are required to emplace and fire the kit.

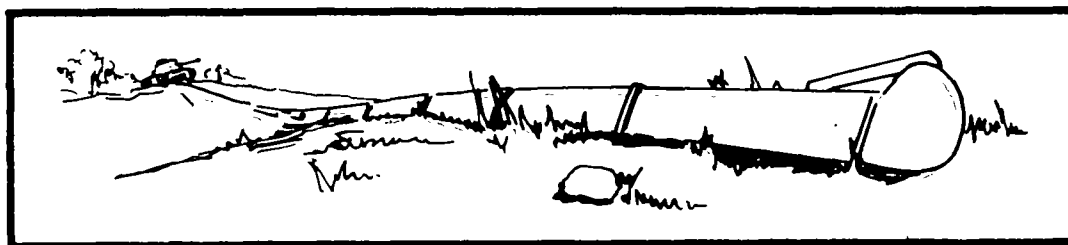
M157 PROJECTED CHARGE DEMOLITION KIT

1) Technical characteristics:

Weight - 11,000 lbs
Explosive (wt) - 3,200 lbs
Each set consists of 79 separate sections - 62 center loading sections (5' long) (142 lbs); 13 body sections (inert) (5' long) (79 lbs); 2 impact fuze sections (5' long) (153 lbs); 1 tail section (5' long) (155 lbs)
Breaching path - 4m wide x 90m long
Assembly time - 6 to 8 man-hours per kit
Detonation - Accomplished by the force of the bullet (cal .30 or .50, ball) striking the impact plate

2) Role: To provide a cleared path through an antitank minefield.

3) Remarks: The M157 is assembled in a rear area, towed to the edge of the minefield and then pushed through the minefield. The resultant crater will be about 90m long, 4 to 5m wide, and 1 to 1-1/2m deep.



Actual size when assembled - 12" wide, 7" high, 401' long. Each center loading section and each impact fuze section contains 45 pounds composition B and 5 pounds composition C-4.

Fuze: M603 (same fuze as in the M15 AT mine).

1) Technical characteristics:

Weight - 3,100 lbs

Explosive - 1,500 lbs (comp C-4)

Dimensions of kit hull - 145" long, 24" high, 56.5" wide

Breaching path - 4m wide x 70m long

Assembly time - 0.5 manhours per kit

Detonation - Accomplished via a 250' electric cable and a *four position* firing control switch located inside the tow vehicle (must have a 24-volt system)

TOW position - Disconnect tow cable from tow vehicle

COVER position - Removes cover from hull

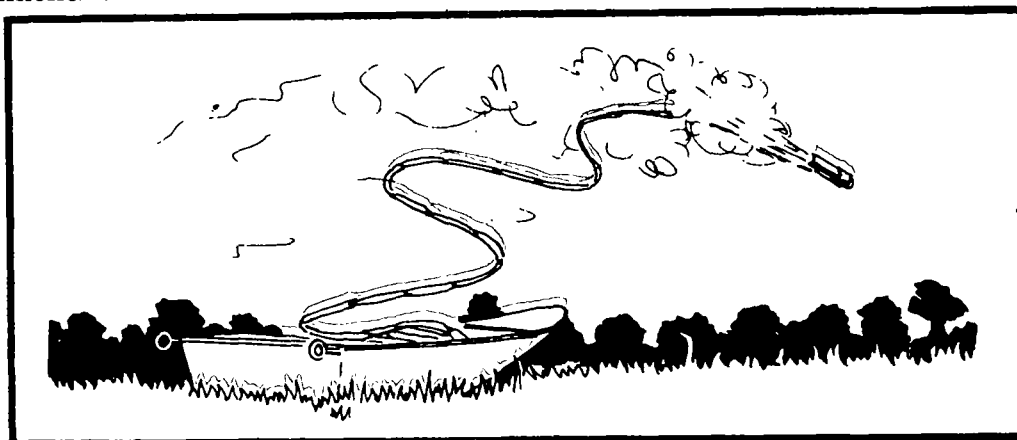
ROCKET position - Fires rocket motor M95 and propels charge across minefield

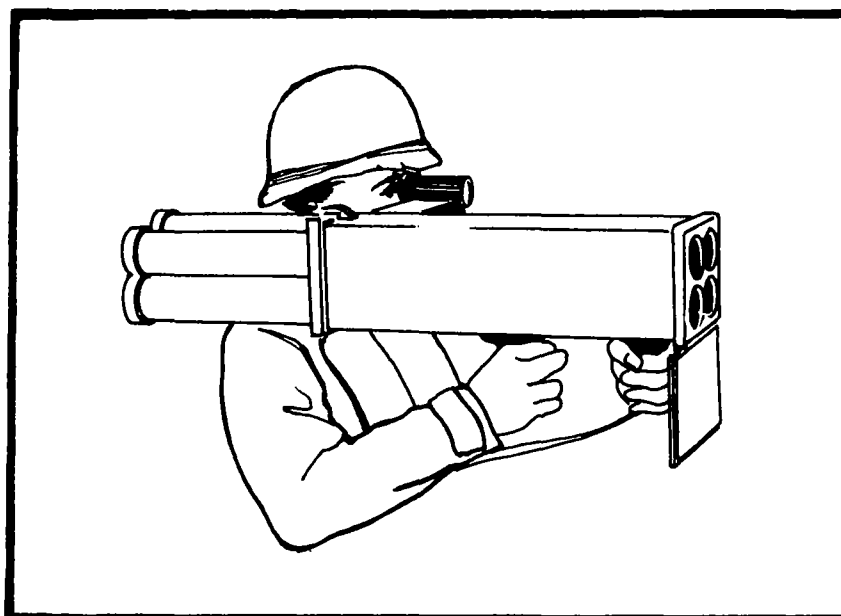
CHARGE position - Fires charge

M173 PROJECTED CHARGE DEMOLITION KIT

2) Role: Rapid breaching of minefields.

3) Remarks: This antitank minefield device is towed to the edge of the minefield where the linear charge is projected across the minefield by a rocket. The linear charge is then detonated to clear a path in the minefield.



**M202
ROCKET
LAUNCHER****1) Technical characteristics:****Launcher***Weight* - 11.5 lbs unloaded*Length* - 2' 3" closed; 2' 11" ready to fire**M74 incendiary rocket***Maximum range* - 750m*Minimum range* - 20m*Bursting radius* - 20m (approx)*Weight (4 round clip)* - 15.1 lbs**M96 CS-2 Rocket***Area coverage* - 5,200 sq ft at 1.5 ft above ground**2) Role:** Multipurpose weapon to fire incendiary or gas rockets.**3) Remarks:** Will replace portable flame-throwers. The launcher is reusable, but is considered a throwaway weapon after the sight has been removed.

1) Technical characteristics:

Dragon is a command to line-of-sight guided missile system. The missile is automatically guided along the gunner's line of sight by a sensor device, which controls the missile through a wire link. Dragon consists of two major parts, the tracker and the round.

DRAGON MEDIUM ANTITANK ASSAULT WEAPONS SYSTEM M47

Minimum range - 65m

Maximum range - 1,000m

Team - 2 men

Tracker and round mated

Weight - 30.87 lbs

Length - 44"

Diameter - 10"

Height - 51" max, 38" min

Tracker

Weight - 6.58 lbs

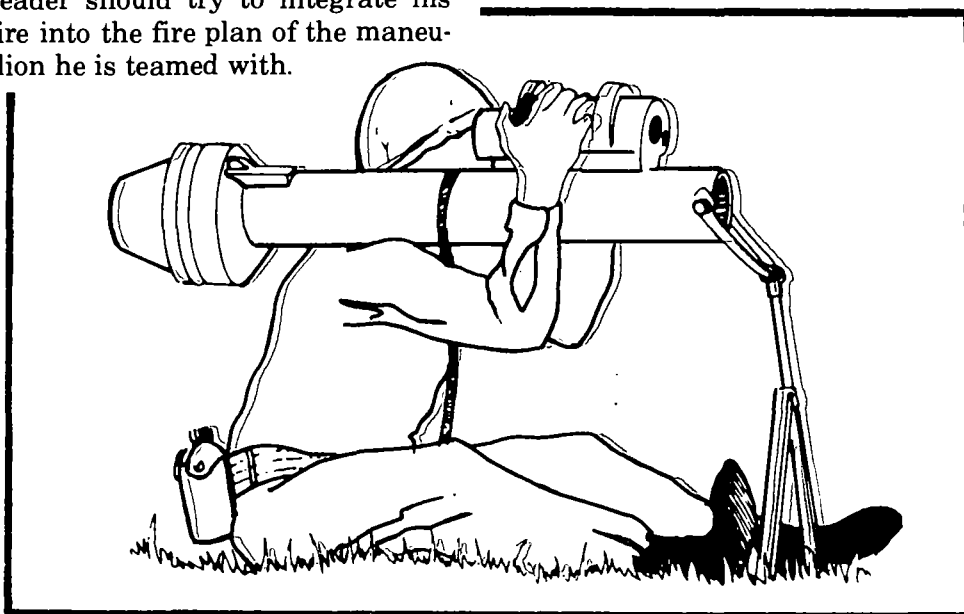
Length - 13.63

Width - 9.5"

Height - 6.0"

2) Role: Principal platoon antitank weapon; its primary role is to destroy enemy armor. Dragon may be employed in a secondary role of providing fire support against point targets such as bunkers.

3) Remarks: The Dragon is the platoon leader's antitank weapon and should be positioned and controlled by him. The platoon leader should try to integrate his Dragon fire into the fire plan of the maneuver battalion he is teamed with.



**LIGHTWEIGHT
ANTITANK
WEAPON
M72A2**

1) Technical characteristics:

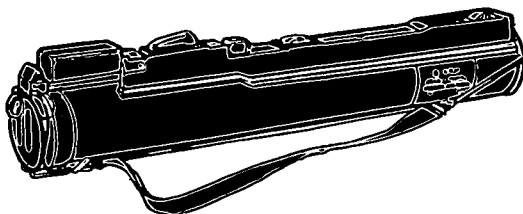
Weight - 5.2 lbs

Length - 2' 2" closed; 2' 11" extended

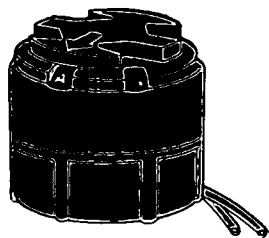
Maximum effective range - 200m

2) Role: Short range antitank weapon. The LAW can also be used against point targets like bunkers.

3) Remarks: The LAW is issued as a round of ammunition and not as a weapon. Once the LAW has been fired, the container is discarded.



ANTIPERSONNEL MINES



M14 Blast Antipersonnel Mine

Diameter - 2 3/16"

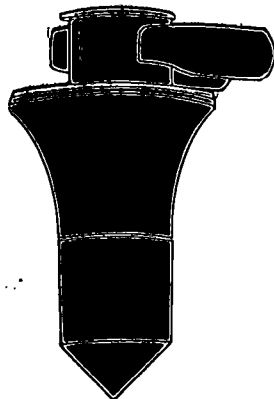
Height - 1 9/16"

Weight - 3 1/3 oz

Explosive - 1 oz TETRYL

Fuze - Integral (with belleville spring)

Functioning - Penetrate boot and foot



M25 Blast Antipersonnel Mine (Elsie)

Diameter - 1 1/8"

Height - 3 5/8"

Weight - 2 3/4 oz

Explosive - 1/3 oz shape charge

Fuze - integral (w/ball release)

Functioning - with 14 to 26 lbs pressure.

Penetrate boot and foot

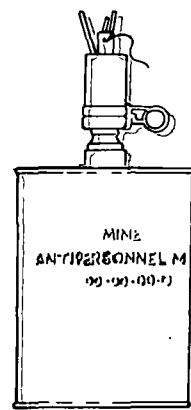
M18A1 Fragmentation Antipersonnel Mine

Length - 8 1/2"
Width - 1 3/8"
Height - 3 1/4"
Weight - 3.5 lbs.
Explosives - 1.5 lb C4
Projectiles - 700 steel balls
Equipment - One electric cap and 30m firing wire per mine. One electric firing device per mine. One tester per 6 mines.



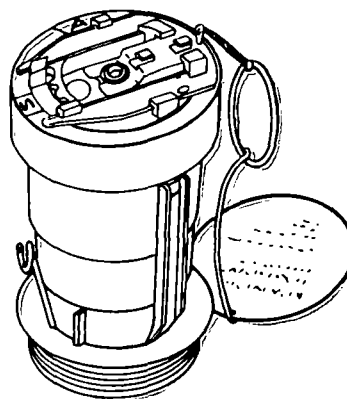
M16A1 Bounding Antipersonnel Mine

Diameter - 4"
Height (w/fuze) - 8"
Weight - 8.25 lbs
Projectiles - Steel
Functioning - Pressure, 8 - 20 lbs; pull, 8 - 10 lbs
Bounding height - 6-1.2m
Casualty radius - 30m

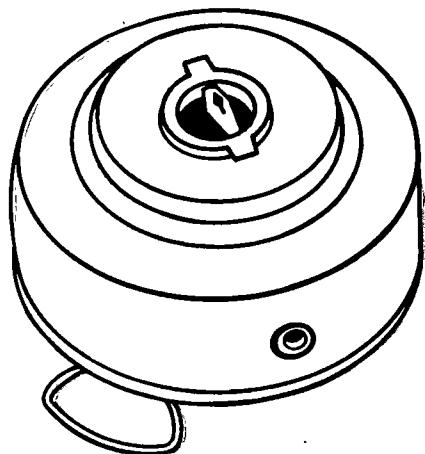


M26 Bounding Antipersonnel Mine

Diameter - 3.1"
Height - 5.7"
Weight - 2.2 lbs
Projectiles - Pellets
Fuze - Integral
Functioning - Pressure, 14-28 lbs; pull - 4-8 lbs
Bounding height - 3m
Casualty radius - 17m



ANTITANK MINES



M15 Heavy Antitank Mine

Diameter - 13 1/8"

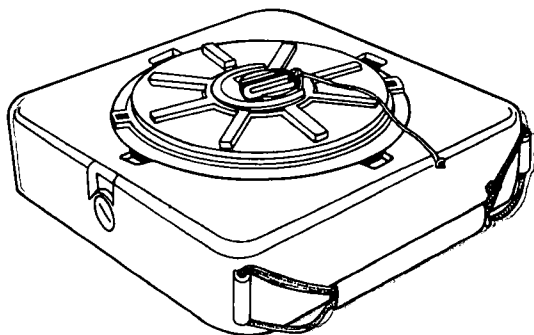
Height - 5"

Weight - 30 lbs

Explosive - 22 lbs

Secondary fuze wells - 2 fuzes

Functioning— M603 fuze functions with 300 to 400 lbs pressure. M608 fuze resistant to blast type countermeasures. Functions with 200 to 350 lbs of pressure lasting 250 to 450 milliseconds



M19 Plastic Heavy Antitank Mine

Length - 13"

Width - 13"

Height - 3"

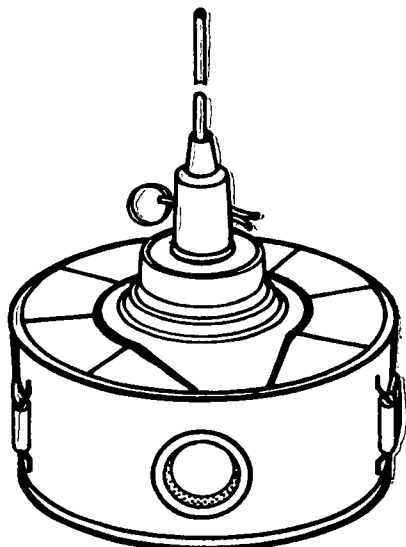
Weight - 28 lbs

Explosive - 21 lbs

Secondary fuze wells - 2 fuzes

Functioning - fuze - M606 integral (with pneumatic plate)

Functions with 350 to 500 lbs of pressure



M21 Metallic (Killer) Antitank Mine

Diameter - 9 1/2"

Height - 4 1/2"

Weight - 18 lbs

Explosive - 10.5 lbs

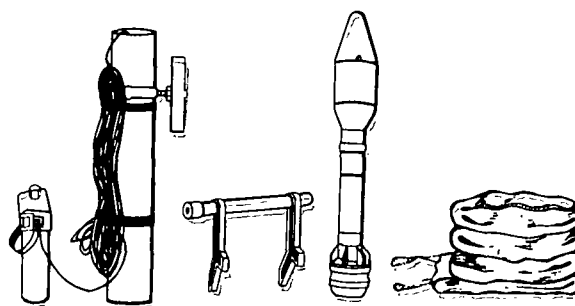
Fuze - M607

Functioning - 290 lbs pressure on pressure ring or 20° deflection of tilt rod

M24 Off Route Mine

Effective Range - 30m

Components - M61 firing device; discriminator assembly, sighting device, bipod assembly, launching tube, 3.5" rocket.



M66 Off Route Mine

The M66 differs from the M24 by using a seismic alerter and infrared firing device instead of the pressure discriminator tape.

POSSIBLE MINE EMPLOYMENT

M14 and M25 Antipersonnel (Blast) Mines

- Should be emplaced with metallic antipersonnel, antitank, or chemical mine to confuse and hinder enemy breaching attempts.
- Ideal for employment as a boobytrap in obscure places such as stairs and cellars.

M16A1 and M26 Antipersonnel (Bounding Fragmentation) Mines

- Ideal for covering large areas such as rooftops, backyards, parks, and cellars.
- Hasty protective minefields and in standard minefields.
- Can be command detonated.

M19 Nonmetallic Mine

- Can be employed same as the M15.
- Can be used in underwater mining of potential fords.

M24 and M66 Off Route Mines

- Can be employed on secondary roads to give early warning and tank/vehicle destruction.
- At OP/LP position.
- In streets or alleys to block routes of advance in narrow defiles.
- In large defensive/barrier minefield.
- For possible command detonation from ambush position at checkpoints.

M15 and M21 Antitank Mines

- Can be employed in conjunction with other artificial obstacles covered with fire.
- In streets or alleys to block routes or advance in narrow defiles.

Appendix B

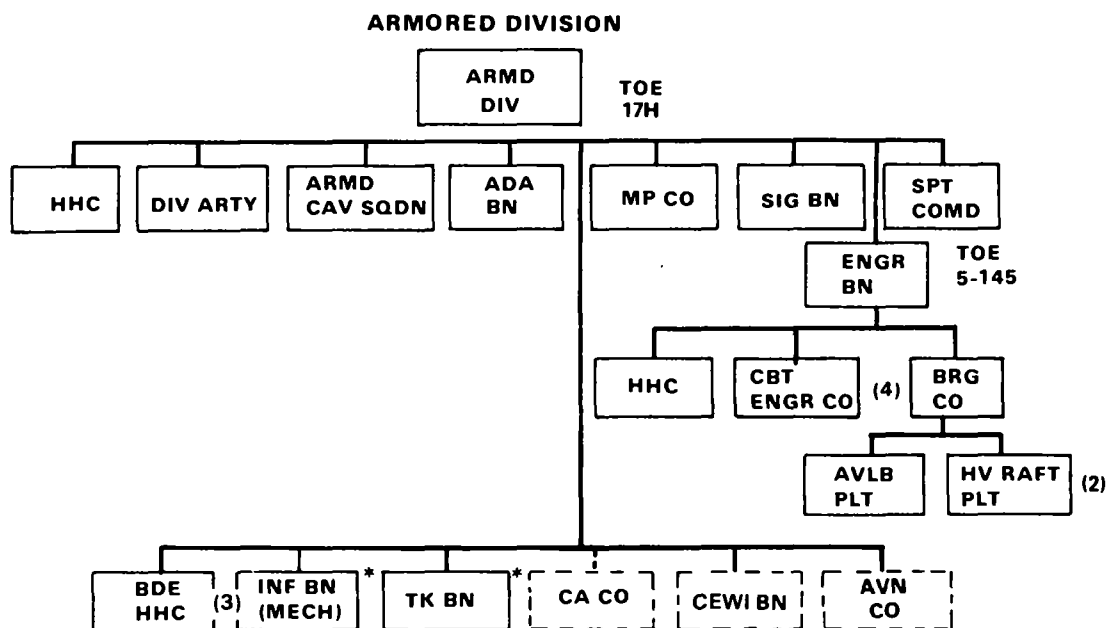
ORGANIZATIONS

This appendix provides information on organization of maneuver units and engineer units. In addition, the appendix provides information on mission, capabilities and equipment of engineer organizations that could provide support to the division.

Contents

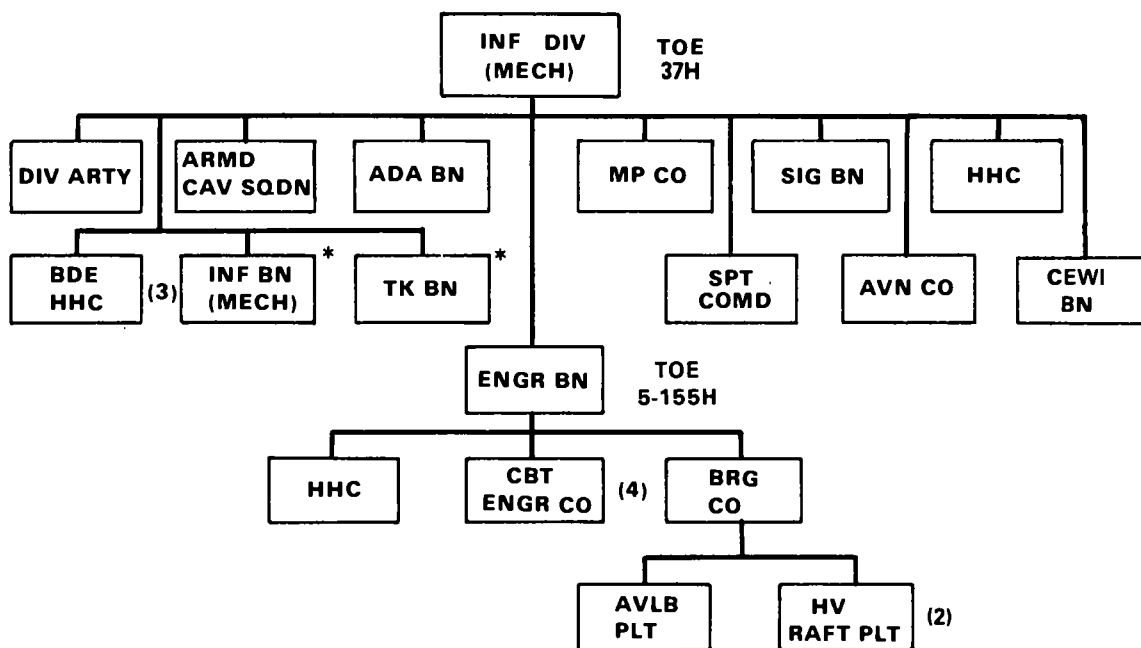
MANEUVER UNIT ORGANIZATIONS	B-1
DIVISION AND BRIGADE ENGINEER UNITS	B-6
CORPS AND TOPOGRAPHIC ENGINEER BATTALIONS	B-15
SEPARATE ENGINEER COMPANIES	B-19
ENGINEER UNIT ALLOCATION	B-23

MANEUVER UNIT ORGANIZATIONS



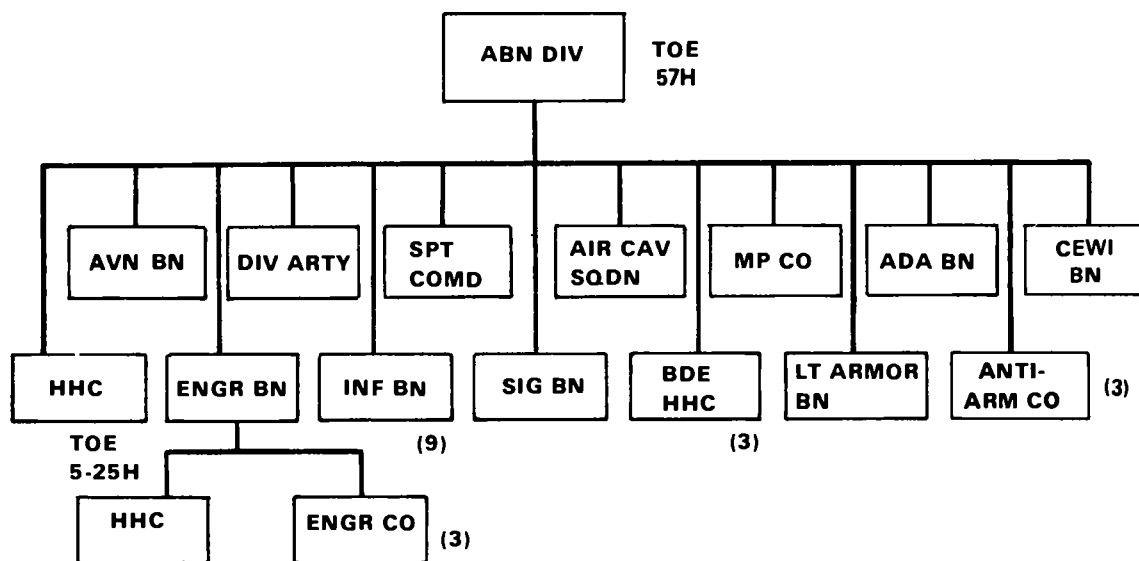
* Type and number of maneuver battalions may vary

INFANTRY DIVISION (MECHANIZED)

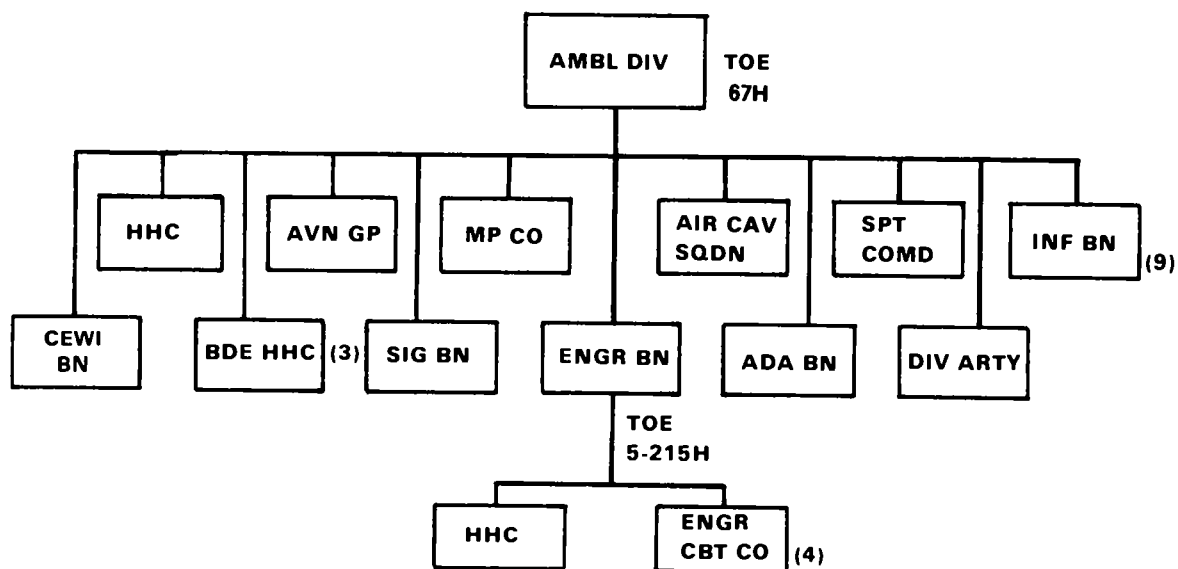


* Type and number of maneuver battalions may vary

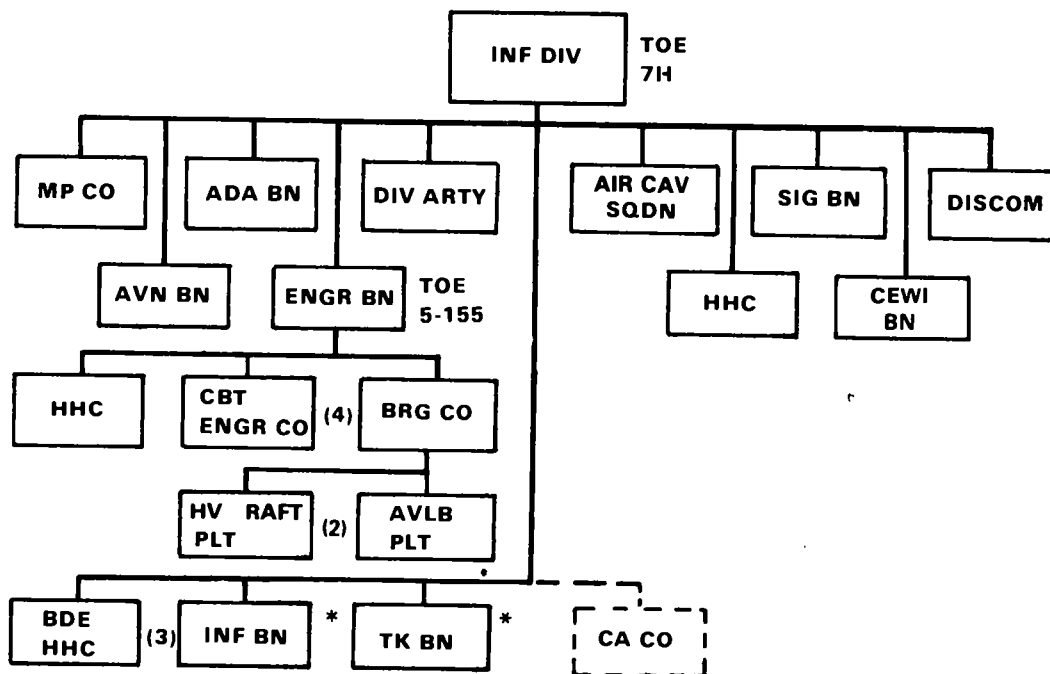
AIRBORNE DIVISION



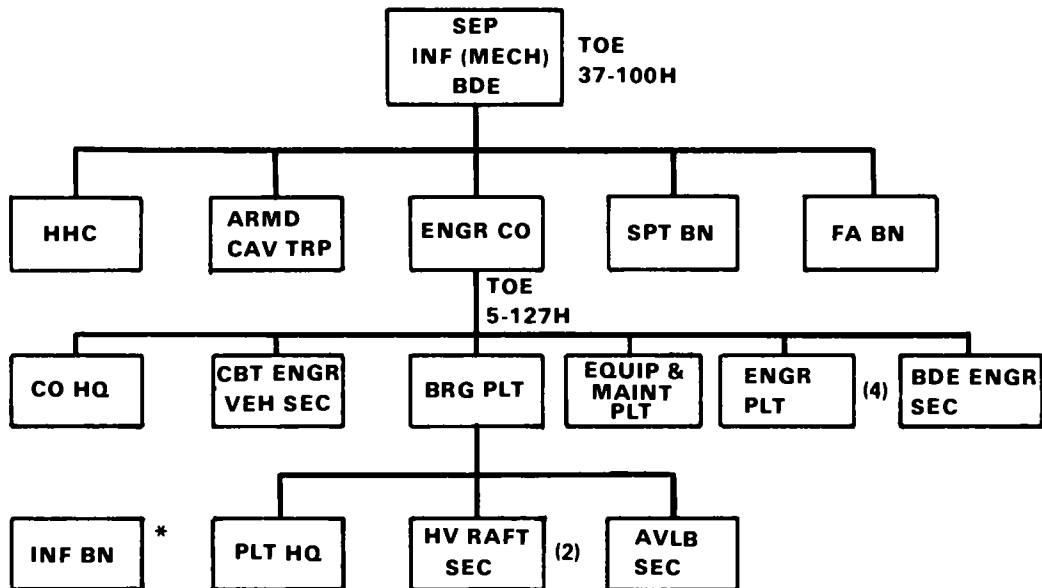
AIRMOBILE DIVISION



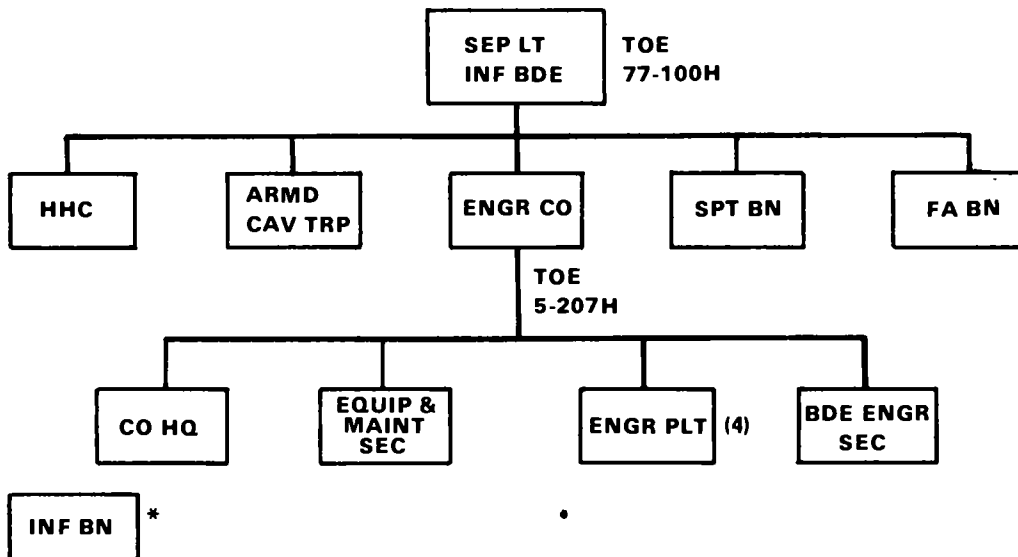
INFANTRY DIVISION



* Number and type of maneuver battalions may vary.

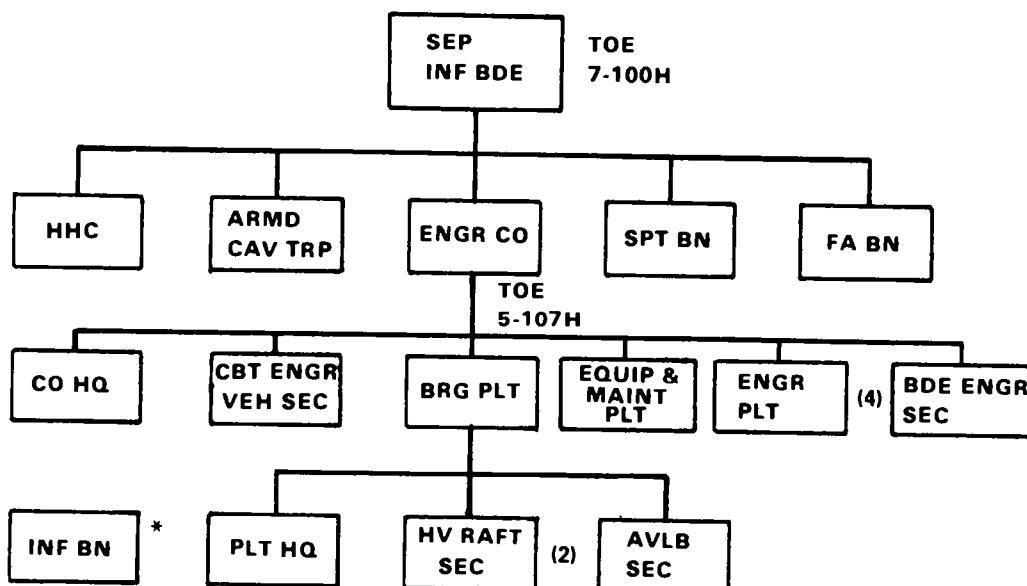
SEPARATE INFANTRY (MECHANIZED) BRIGADE.

* Number and type of maneuver battalions may vary

SEPARATE LIGHT INFANTRY BRIGADE.

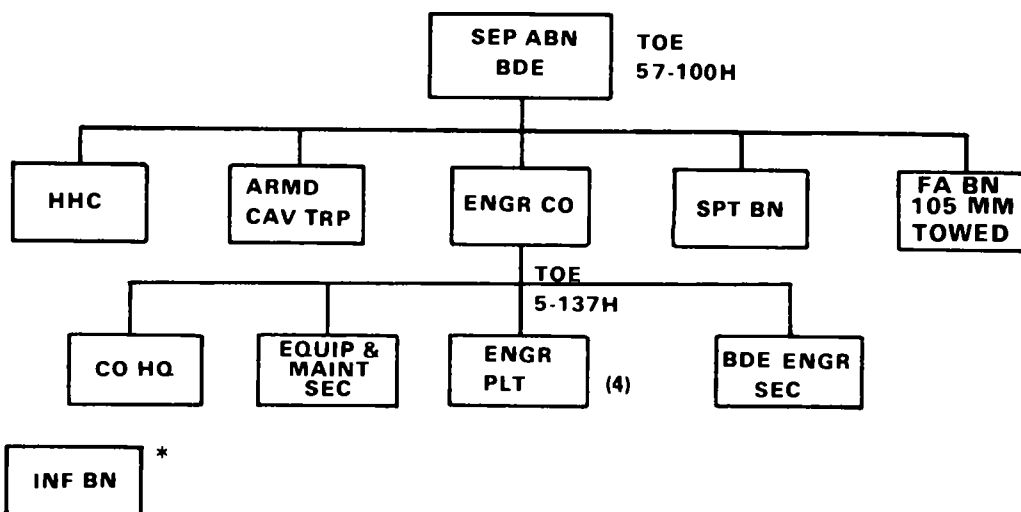
* Number and type of maneuver battalions may vary.

SEPARATE INFANTRY BRIGADE.



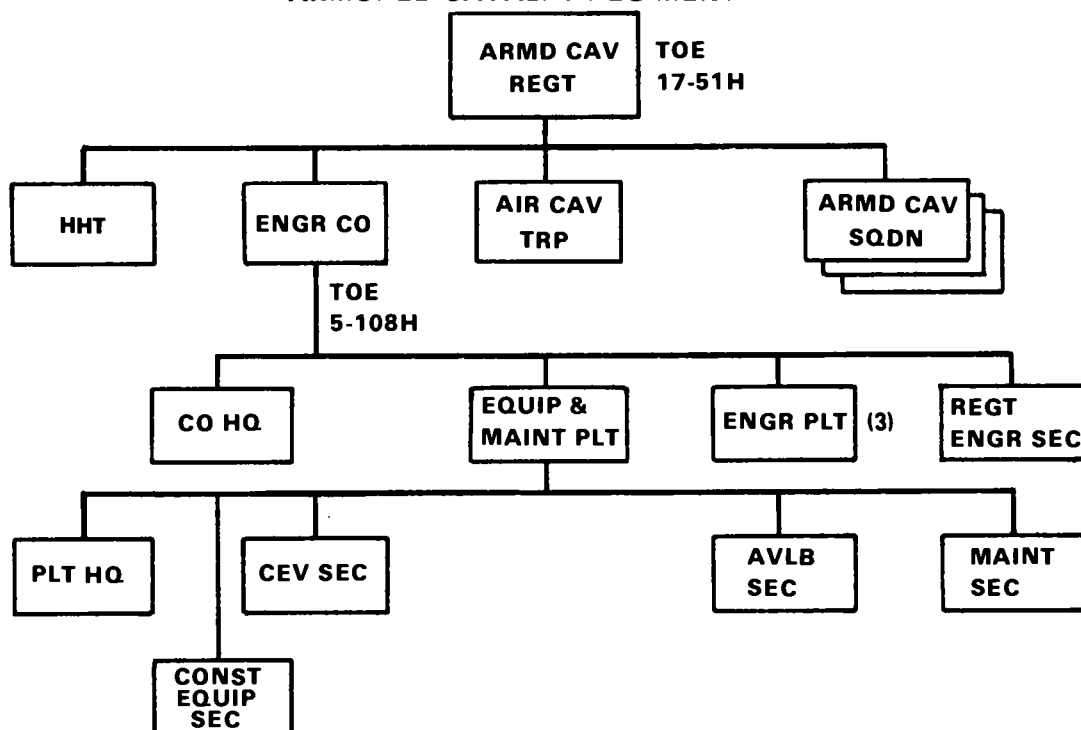
* Number and type of maneuver battalions may vary

SEPARATE AIRBORNE BRIGADE.



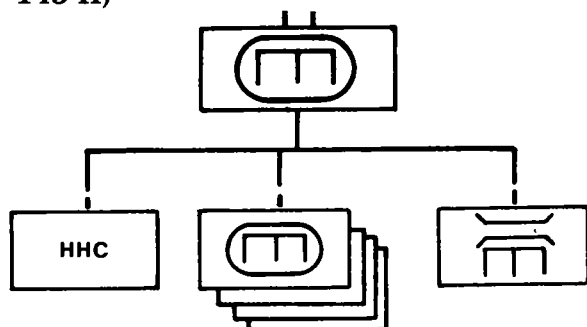
* Number and type of maneuver battalions may vary.

ARMORED CAVALRY REGIMENT



DIVISION AND BRIGADE ENGINEER UNITS

Engineer Battalion, Armored Division or Infantry Div (Mechanized) (TOE 5-145 H)



1. Mission

a. To increase the combat effectiveness of the armored and infantry (mechanized) division.

b. To undertake and carry out an infantry combat mission when required.

2. Capabilities

a. Emplace and remove obstacles to include mines and boobytraps.

b. Engage in hasty stream crossings with

boats, rafts, and bridges; coordinate organic and attached engineer troops in the deliberate stream crossing.

c. Construct, repair, and maintain roads, bridges, fords, culverts, landing strips and helipads.

d. Assist in the assault of fortified positions.

e. Install and operate potable water supply facilities.

f. Provide engineer reconnaissance and produce engineer intelligence.

g. Provide technical assistance to other troops in preparation of fortifications and camouflage.

3. Organization

a. The battalion consists of a headquarters and headquarters company (HHC), four line companies and a bridge company.

b. The HHC is organized into the normal staff sections plus equipment platoon.

c. The line companies have 5 officers and 154 enlisted men organized into a company

HQ and three platoons. The squad vehicle is the armored personnel carrier (M113).

d. The bridge company has 5 officers and 146 enlisted men organized into two heavy raft sections, one armored vehicle launched bridge (AVLB) section and a company HQ. The heavy raft sections may have the mobile assault bridge (MAB) or M4T6 float bridge.

4. Equipment

HHC

- 2 20-ton cranes
- 4 graders
- 3 dozers
- 1 sheepsfoot roller
- 1 vibratory roller
- 1 900-gallon distributor
- 6 5-ton dump trucks
- 5 1,500-gph water purification units
- 4 mine detectors, metallic/nonmetallic
- 5 mine detectors, metallic
- 10 1/4-ton utility trucks
- 10 1 1/4-ton cargo trucks
- 10 2 1/2-ton cargo trucks
- 3 command post trucks
- 1 10-ton wrecker
- 3 10-ton tractors
- 1 5-ton tractor
- 1 maintenance contact truck
- 1 ambulance
- 2 tracked recovery vehicles
- 4 250-gallon fuel tankers
- 1 5-ton cargo truck
- 1 rough terrain forklift
- 3 sets scuba diving equipment
- 1 semitrailer van
- 1 pneumatic tool trailer/250 cfm compressor
- 3 .50 cal machineguns
- 7 7.62mm machineguns

Line Company

- 1 tractor scoop/backhoe (CCE)
- 4 5-ton dump trucks
- 18 chain saws
- 3 pioneer tool outfits
- 6 DRAGONS
- 10 APCs
- 2 CEVs

- 1 bulldozer
- 10 mine detectors, metallic/nonmetallic
- 10 mine detectors, metallic
- 3 2 1/2-ton cargo trucks
- 4 5-ton dump trucks
- 1 10-ton tractor/lowbed
- 1 1/4-ton utility truck
- 3 1 1/4-ton cargo trucks
- 2 2 1/2-cu yd scoop loader
- 1 pneumatic tool trailer/250 cfm compressor
- 13 .50 cal machineguns
- 7 7.62mm machineguns

Bridge Company with MABs

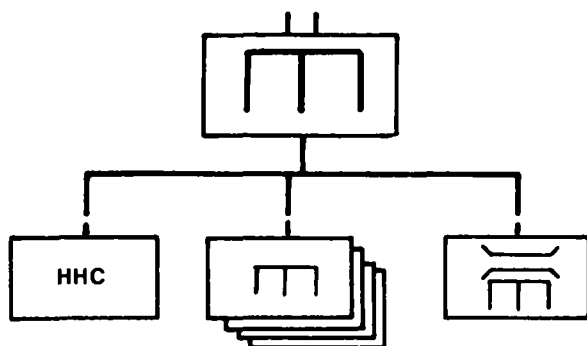
- 16 MAB interior bays
- 8 MAB end bays
- 1 20-ton crane
- 4 AVLB launchers
- 6 AVLB bridges
- 1 dozer
- 2 light tactical raft motors
- 8 outboard motors
- 18 15-man assault boats
- 1 1 1/4-ton cargo truck
- 17 2 1/2-ton cargo trucks
- 3 10-ton tractors/lowbed
- 6 1/4-ton utility trucks
- 4 mine detectors, metallic/nonmetallic
- 5 mine detectors, metallic
- 2 raft ferry conversion sets
- 1 .50 cal machinegun
- 4 7.62mm machineguns

Bridge Company with M4T6

- 4 M4T6 bridge sets
- 23 2 1/2-ton cargo trucks
- 48 5-ton stake trucks
- 18 15-man assault boats
- 2 light tactical raft sets
- 8 27-ft bridge erection boats
- 4 AVLB launchers
- 6 AVLB bridges
- 1 dozer
- 8 outboard motors
- 48 5-ton stake trucks
- 1 20-ton crane
- 1 1 1/4-ton cargo truck
- 25 2 1/2-ton cargo trucks
- 3 10-ton tractors/lowbed
- 6 1/4-ton utility trucks
- 1 10-ton wrecker
- 4 mine detectors, metallic/nonmetallic

- 5 mine detectors, metallic
- 2 pneumatic tool trailers/250 cfm compressor
- 1 .50 cal machinegun
- 4 7.62mm machineguns

Engineer Battalion, Infantry Division (TOE 5-155 H)



1. Mission

a. To increase the combat effectiveness of the infantry division.

b. To carry out an infantry mission when required.

2. Capabilities

a. Emplace and remove obstacles to include mines and boobytraps.

b. Engage in hasty stream crossings with boats, rafts, and bridges; coordinate organic and attached engineer troops in the deliberate stream crossing.

c. Construct, repair, and maintain roads, bridges, fords, culverts, landing strips and helipads.

d. Assist in the assault of fortified positions.

e. Install and operate potable water supply facilities.

f. Provide engineer reconnaissance and produce engineer intelligence.

g. Provide technical assistance to other troops in preparation of fortifications and camouflage.

3. Organization

a. The battalion consists of an HHC, four line companies (one in augmentation), and a

bridge company.

b. The HHC is organized into the normal staff sections plus an equipment platoon.

c. The line companies have 5 officers and 144 enlisted men organized into a company HQ and three platoons. The squad vehicle is the 5-ton dump truck.

d. The bridge company has 5 officers and 146 enlisted men organized into two heavy raft sections, one armored vehicle launch bridge (AVLB) section and a company headquarters (HQ). The heavy raft sections may have the mobile assault bridge (MAB) or M4T6 float bridge.

4. Equipment

HHC

- 2 20-ton cranes
- 4 graders
- 3 dozers
- 6 5-ton dump trucks
- 1 pneumatic tool trailer/250 cfm compressor
- 5 1,500-gph water purification units

Line Company

- 1 2 1/2-cu yd scooploader
- 1 tractor scoop/backhoe (CCE)
- 2 dozers
- 13 5-ton dump trucks
- 1 pneumatic tool trailer/250 cfm compressor
- 12 chain saws
- 3 pioneer tool outfits

Bridge Company with M4T6

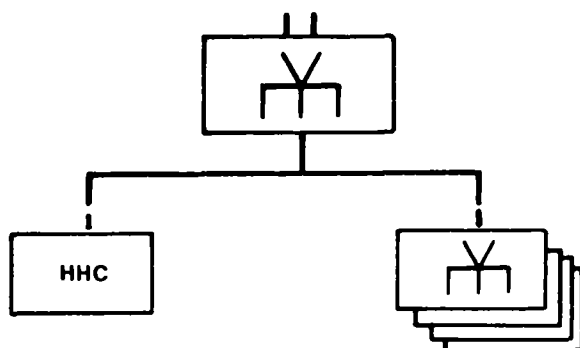
- 4 M4T6 bridge sets
- 23 2 1/2-ton cargo trucks
- 48 5-ton stake trucks
- 18 15-man assault boats
- 2 light tactical raft sets
- 8 27-ft bridge erection boats
- 4 AVLB launchers
- 6 AVLB bridges
- 1 dozer
- 8 outboard motors

- 1 pneumatic tool trailer/250 cfm compressor

Bridge Company with MABs

- 16 MAB interior bays
- 8 MAB end bays
- 1 20-ton crane
- 4 AVLB launchers
- 6 AVLB bridges
- 1 dozer
- 2 light tactical raft sets
- 8 outboard motors
- 18 15-man assault boats

Engineer Battalion, Airmobile Division (TOE 5-215 H)



1. Mission

- a. To increase the combat effectiveness of the airmobile division by means of combat engineer support.
- b. To perform infantry combat missions when required.

2. Capabilities

- a. Emplace and remove obstacles and fortifications.
- b. Construct, repair, and maintain roads, bridges, fords, culverts, landing strips and helipads.
- c. Provide combat engineer elements which operate as part of the combined arms team.
- d. Install and operate potable water supply facilities.
- e. Provide engineer reconnaissance and produce engineer intelligence.

- f. Provide technical assistance to other troops in preparation of fortifications and camouflage.

3. Organization

- a. The battalion consists of an HHC and four line companies (one in augmentation).
- b. The HHC is organized into the normal staff sections plus an equipment platoon.
- c. The line companies have 5 officers and 115 enlisted men organized into a company HQ and three platoons. The squad vehicle is the 2 1/2-ton dump truck.

4. Equipment

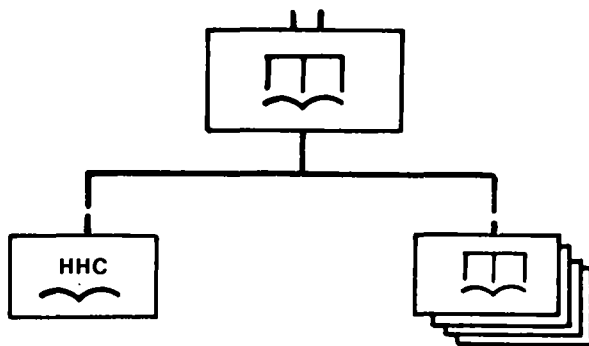
HHC

- 2 wheeled cranes
- 8 sectionalized graders
- 4 sectionalized loaders
- 4 9-wheel rollers
- 4 sectionalized dozers
- 8 light dozers
- 4 scrapers
- 5 mine detectors, metallic/nonmetallic
- 6 mine detectors, metallic
- 14 1/4-ton utility trucks
- 1 ambulance
- 7 1 1/4-ton cargo trucks
- 2 2 1/2-ton cargo trucks
- 19 2 1/2-ton dump trucks
- 1 5-ton wrecker
- 1 rough terrain forklift
- 4 wheeled tractors
- 10 7.62mm machineguns

Line Company

- 9 2 1/2-ton dump trucks
- 1 tractor scoop/backhoe (CCE)
- 21 chain saws
- 1 pioneer tool outfit
- 13 mine detectors, metallic/nonmetallic
- 10 mine detectors, metallic
- 4 1/4-ton utility trucks
- 1 1 1/4-ton cargo truck
- 1 2 1/2-ton cargo truck
- 6 Dragons
- 12 7.62mm machineguns

Engineer Battalion, Airborne Division (TOE 5-25 H)



1. Mission

a. To increase the combat effectiveness of the airborne division.

b. To undertake and carry out airborne infantry combat missions when required.

2. Capabilities

a. Emplace and remove obstacles, including mines and boobytraps.

b. Provide limited general construction works, including construction of assault landing strips.

c. Provide limited construction, repair, and maintenance of roads, bridges, fords, and culverts to facilitate the movements of the division.

d. Assist in the assault of fortified positions.

e. Provide engineer reconnaissance and produce engineer intelligence for the division.

f. Install and operate potable water supply facilities.

g. Provide engineers and equipment in airborne operations.

3. Organization

a. The battalion consists of an HHC and four line companies (one in augmentation).

b. The HHC is organized into the normal staff sections plus an equipment platoon.

c. The line companies have 5 officers and 135 enlisted men organized into a company HQ and three platoons. The squad vehicle is the 1 1/4-ton cargo truck.

4. Equipment

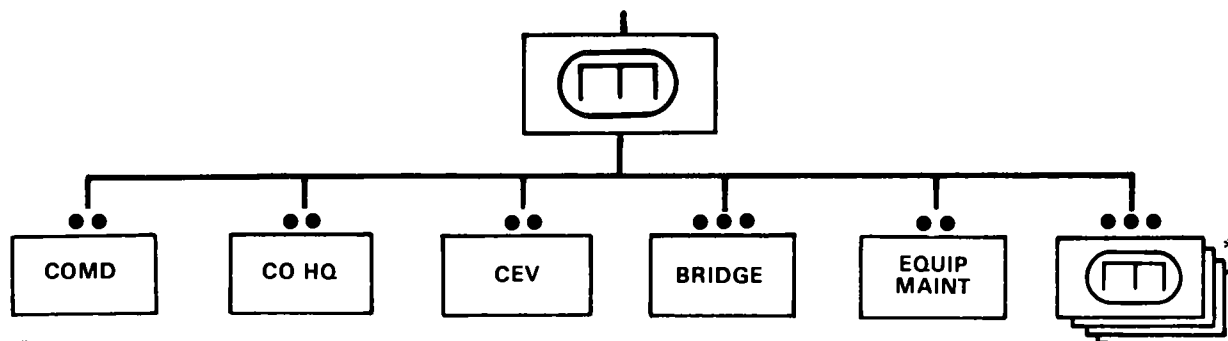
HHC

- 4 graders, abn
- 4 loaders, 2 1/2-cu yd
- 1 vibratory roller
- 1 pneumatic roller
- 1 sheepsfoot roller
- 6 sectionalized dozers
- 8 420-gph water purification units
- 3 mine detectors, metallic/nonmetallic
- 5 mine detectors, metallic
- 6 5-ton dump trucks
- 2 pneumatic tool trailers/250 cfm compressor
- 14 1/4-ton utility trucks
- 9 1 1/4-ton cargo trucks
- 6 5-ton dump trucks
- 12 2 1/2-ton dump trucks
- 1 5-ton wrecker
- 1 ambulance
- 4 2 1/2-ton cargo trucks
- 1 rough terrain forklift
- 1 .50 cal machinegun
- 9 7.62mm machineguns

Line Company

- 3 paving breakers
- 3 pioneer tool outfits
- 1 tractor/scoop/backhoe (CCE)
- 10 mine detectors, metallic/nonmetallic
- 10 mine detectors, metallic
- 5 1/4-ton utility trucks
- 14 1 1/4-ton cargo trucks
- 1 2 1/2-ton cargo truck
- 4 2 1/2-ton dump trucks
- 6 Dragons
- 9 chain saws
- 1 .50 cal machinegun
- 14 7.62mm machineguns

**Engineer Company, Separate Armored
Brigade or Separate Infantry Brigade
(Mechanized) (TOE 5-127 H)**



*One in augmentation

1. Mission

a. To increase the combat effectiveness of the separate armored brigade and the separate infantry brigade (mechanized) by providing engineer combat support.

b. To conduct limited infantry combat missions when required.

2. Capabilities

a. Provide the capability to accomplish engineer combat tasks.

b. Provide engineer reconnaissance capability to the brigade.

c. Provide bridging support to the brigade.

d. Operate two water supply points for the brigade.

3. Organization

a. The company has 7 officers and 245 enlisted men and is commanded by a major. It is organized into three line platoons, a bridge platoon, an equipment and maintenance section, a combat engineer vehicle section, a command section, and company headquarters.

b. The line platoons have three squads and the squad vehicle is the armored personnel carrier.

c. The bridge platoon can be equipped with mobile assault bridge (MAB), M4T6 float bridge or ribbon bridge.

4. Equipment

Sections

- 1 20-ton crane
- 1 airborne grader
- 2 2 1/2-cu yd loaders
- 2 dozers
- 2 1,500-gph water purification units
- 1 tractor scoop/backhoe (CCE)
- 2 CEVs
- 1 5-ton dump truck
- 2 AVLB launchers
- 3 AVLB bridges
- 1 pneumatic tool trailer/250 cfm compressor

Line Platoon

- 1 5-ton dump truck
- 1 pioneer tool outfit
- 3 chain saws

Bridge Platoon w/MAB

- 1 light tactical raft
- 9 15-man boats
- 8 MAB interior bays
- 4 MAB end bays

w/M4T6

- 1 light tactical raft
- 9 15-man boats
- 2 M4T6 float bridges
- 2 bridge erection sets
- 4 bridge boats

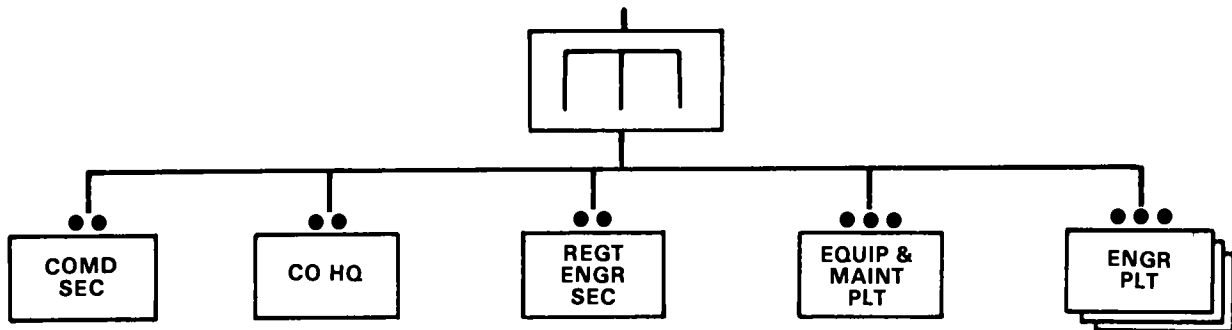
w/Ribbon

- 1 light tactical raft

9 15-man boats
10 ribbon interior bays

4 ribbon ramp bays
6 bridge boats

Engineer Company, Armored Cavalry Regiment (TOE 5-108 H)



1. Mission

- a. To increase the combat effectiveness of the armored cavalry regiment by providing engineer combat support.
- b. To provide an engineer staff section for the regiment.

2. Capabilities

- a. Accomplish engineer combat tasks.
- b. Perform engineer reconnaissance.
- c. Operate two water supply points for the regiment.
- d. Provide the capability to span two 60-foot gaps with class 60 armored vehicle launched bridge (AVLB).

3. Organization

- a. The company has 8 officers and 190 enlisted men and is commanded by a major.

It is organized into three line platoons, an equipment and maintenance platoon, regimental engineer section, command section, and the company headquarters.

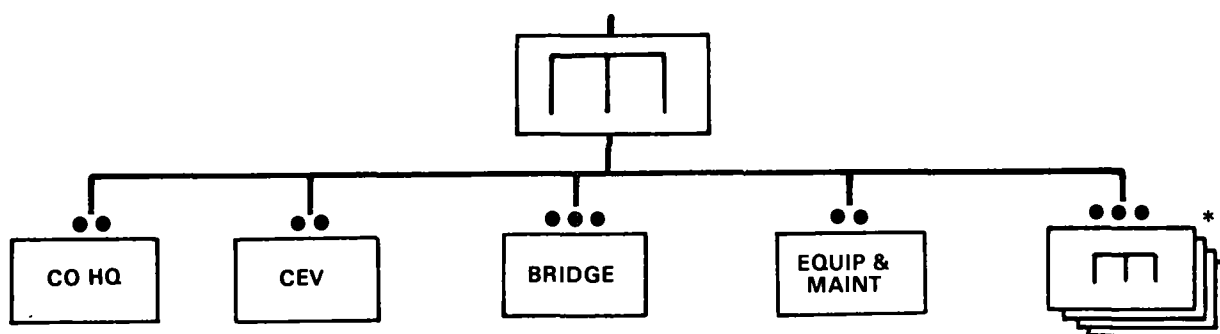
- b. The line platoons have three squads and the squad vehicle is the armored personnel carrier.

- c. The equipment and maintenance platoon has four sections: construction equipment section, CEV section, AVLB section, and the maintenance section.

4. Equipment

- 4 5-ton dump trucks
- 2 AVLB bridges
- 1 grader
- 2 2 1/2-cu yd loaders
- 1 pneumatic tool set
- 9 chain saws
- 2 dozers
- 1 tractor scoop/backhoe (CCE)
- 2 1500 GPH water purification units
- 3 CEV

Engineer Company, Separate Infantry Brigade (TOE 5-107 H)



*One in augmentation

1. Mission

a. To increase the combat effectiveness of the separate infantry brigade by providing engineer combat support.

b. To undertake and carry out a limited infantry combat mission when required.

2. Capabilities

a. Provide the capability to accomplish engineer combat tasks.

b. Provide engineer reconnaissance capability to the brigade.

c. Provide bridging support to the brigade.

d. Operate two water supply points for the brigade.

3. Organization

a. The company has 7 officers and 242 enlisted men. It is organized into four line platoons, a bridge platoon, an equipment maintenance section, combat engineer vehicle section, and a company headquarters.

b. The line platoons have three squads and the squad vehicle is the 5-ton dump truck.

c. The bridge platoon can be equipped with mobile assault bridge (MAB), M4T6 float bridge or ribbon bridge.

4. Equipment

Sections

- 1 20-ton crane
- 1 grader
- 2 2 1/2-cu yd loaders
- 2 dozers
- 2 1,500-gph water purification units
- 1 tractor scoop/backhoe (CCE)
- 2 CEV
- 1 5-ton dump truck
- 1 pneumatic tool outfit

Line platoon

- 4 5-ton dump trucks
- 1 pioneer tool outfit
- 3 chain saws

Bridge Platoon

- 3 AVLB bridges
- 2 AVLB launchers
- 1 light tactical raft
- 9 15-man boats

w/MAB

- 8 MAB interior bays
- 4 MAB end bays

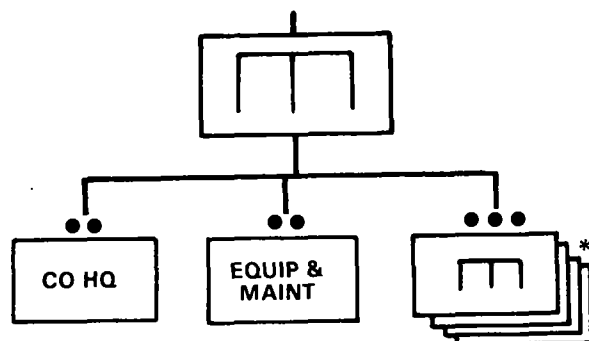
w/M4T6

- 2 M4T6 float bridges
- 2 bridge erection sets
- 2 bridge boats

w/Ribbon

- 10 ribbon interior bays
- 4 ribbon ramp bays
- 6 bridge boats

Engineer Company, Separate Light Infantry Brigade (TOE 5-207 H)



*One in augmentation

1. Mission

To increase the combat effectiveness of the separate light infantry brigade by providing engineer combat support.

2. Capabilities.

- Construct, maintain and repair roads, bridges, fords, and culverts to facilitate the movement of the brigade.
- Provide the capability to accomplish engineer combat tasks.
- Provide engineer reconnaissance and intelligence capability to the brigade.
- Operate water supply points for the brigade.

3. Organization

a. The company has 6 officers and 164 enlisted men. It is organized into four line platoons, an equipment maintenance section and a company headquarters.

b. The line platoons have three squads and the 2 1/2-ton dump truck is the squad vehicle.

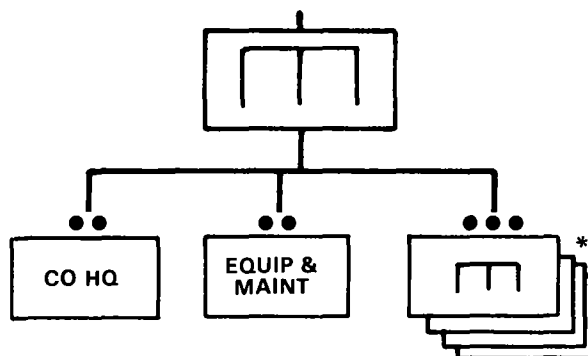
4. Equipment

- 6 2 1/2-ton dump trucks
- 2 graders
- 3 2 1/2-cu yd loader
- 2 dozers
- 1 1,500-gph water purification unit
- 2 tractors scoop/backhoe (CCE)

Line Platoon

- 4 2 1/2-ton dump trucks
- 1 pioneer tool outfit
- 3 chain saws

Engineer Company, Separate Airborne Brigade (TOE 5-137 H)



*One in augmentation

1. Mission

a. To increase the combat effectiveness of the separate airborne brigade by providing engineer combat support.

b. To carry out an infantry combat mission when required.

2. Capabilities

a. Provide close engineer support and when required, carry out infantry missions.

b. Provide limited general construction work, including construction of assault landing strips.

c. Provide engineer reconnaissance and produce engineer intelligence for the brigade.

d. Provide personnel and equipment to operate brigade water supply points.

3. Organization

The company has 6 officers and 149 enlisted men. It is organized into four line platoons, an equipment and maintenance section, and a company headquarters.

4. Equipment

- 5 2 1/2-ton dump trucks
- 2 5-ton dump trucks
- 2 airborne graders
- 2 dozers sectionalized
- 1 tractor scoop/backhoe (CCE)
- 1 scraper
- 1 vibratory roller
- 1 pioneer tool outfit
- 2 420-gph water purification units

Line Platoon

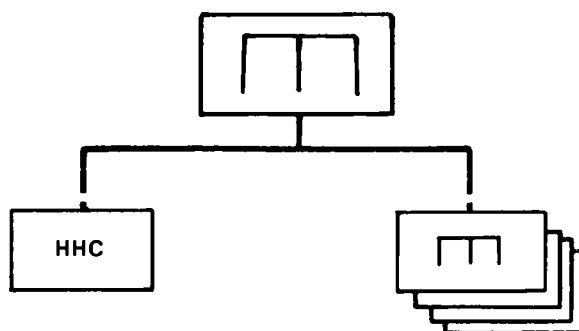
- 4 1 1/4-ton trucks
- 3 chain saws

Co Hq

- 1 2 1/2-ton dump truck
- 2 420-gph water purification units

CORPS AND TOPOGRAPHIC ENGINEER BATTALIONS

Engineer Combat Battalion Corps (TOE 5-35 H)



1. Mission

- a. To increase the combat effectiveness of corps by means of engineer combat support and general engineer work.
- b. To reinforce divisional engineer units when required.
- c. To perform infantry combat missions when required.

2. Capabilities

- a. Construct, repair, and maintain roads, fords, culverts, landing strips, heliports, command posts, supply installation buildings, structures, and related facilities.

- b. Prepare and remove obstacles, to include minefields.

- c. Install and operate field potable water supply facilities. A battalion can operate five water points.

- d. Construct defensive installations.

- e. Engage in river-crossing operations to include assault crossings of troops and construction of tactical rafts and bridges.

- f. Participate in the assault of fortified positions.

- g. Planning and preparation of sites, and supervision of ADM teams in the execution of ADM missions.

3. Organization

- a. The battalion consists of an HHC and four line companies.

- b. The HHC consists of the normal staff and company sections plus an equipment platoon, and a combat construction section. (plumbers, carpenters, and other skilled construction trades).

- c. The line companies consist of 5 officers and 139 EM organized into a company HQ and three platoons. The squad vehicle is the 5-ton dump truck.

4. Equipment

HHC

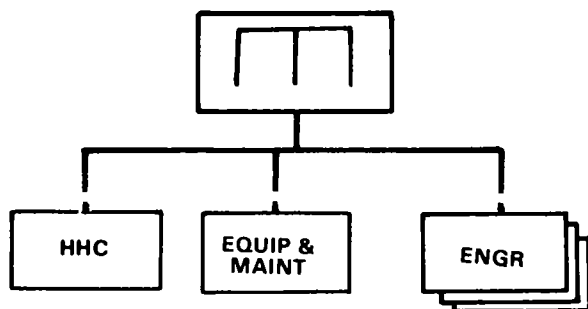
- 3 20-ton cranes
- 4 graders
- 2 2 1/2-cu yd loaders
- 2 dozers
- 1 sheepsfoot roller
- 4 5-ton dump trucks
- 1 16-cu ft mixer
- 5 1,500-gph water purification units
- 4 mine detectors, metallic/nonmetallic
- 6 mine detectors, metallic
- 1 ambulance
- 8 1 1/4-ton utility trucks
- 6 2 1/2-ton cargo trucks
- 1 5-ton tractor
- 10 1/4-ton utility trucks
- 3 5-ton cargo trucks
- 1 5-ton wrecker
- 1 skid-mounted auger

- 1 maintenance contact truck
- 2 tank and pump units, liquid dispensing
- 1 towed vibratory roller
- 1 pneumatic tool trailer/250 cfm compressor
- 1 rough terrain forklift
- 5 7.62mm machineguns

Line Company

- 13 5-ton dump trucks
- 2 dozers
- 1 tamper
- 2 2 1/2-cu yd loaders
- 1 CCE tractor, wheeled with backhoe and loader
- 13 mine detectors, metallic/nonmetallic
- 10 mine detectors, metallic
- 1 1/4-ton utility truck
- 4 1 1/4-ton cargo trucks
- 3 2 1/2-ton cargo trucks
- 1 5-ton cargo truck
- 1 pneumatic tool trailer/250 cfm compressor
- 3 pioneer tool trailers with equipment
- 9 chain saws
- 3 Dragons
- 1 .50 cal machinegun
- 9 7.62mm machineguns

Engineer Combat Battalion, Heavy (TOE 5-115 H)



1. Mission

a. To construct and rehabilitate roads, airfields, pipeline systems, structures, and utilities for the Army and Air Force and to assist in emergency recovery operations.

b. To increase the combat effectiveness of division, corps, and army group forces by

means of engineer combat support and general engineer work.

c. To perform infantry combat missions, when required.

2. Capability

a. Provide construction or rehabilitation of routes of communications, bridges, forward tactical and forward cargo airfields and heliports.

b. Provide general construction of buildings, structures, and related facilities.

c. Provide limited reconstruction of railroads, railroad bridges, and ports.

d. Assist in the emplacement and removal of obstacles, including mines and boobytraps.

e. Provide technical assistance to other troops in preparation of fortifications and obstacles.

f. Assist in the assault of fortified positions.

g. Conduct infantry combat missions when required.

3. Organization

a. The battalion is organized into an HHC, an engineer equipment and maintenance company, and three engineer companies.

b. The engineer companies consist of 6 officers and 186 enlisted men organized into a company headquarters, an equipment maintenance section, a support section, a horizontal construction platoon, and two general construction platoons.

4. Equipment

Line Company

- 1 25-ton crane
- 3 graders
- 3 dozers
- 1 loader, 5-cu yd
- 4 18-cu yd scrapers
- 2 16-cu ft mixers
- 6 20-ton dump trucks
- 2 Dragons
- 2 pneumatic tool trailers/250 cfm compressor

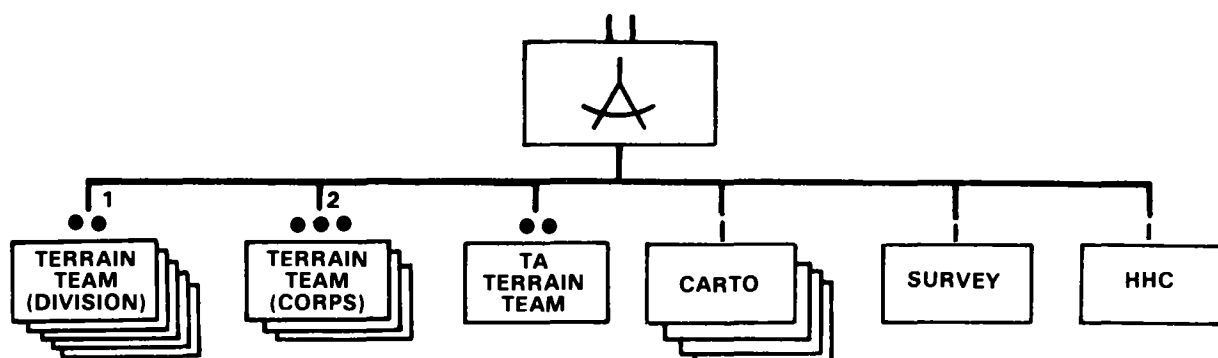
- 4 mine detectors, metallic/nonmetallic
- 5 mine detectors, metallic
- 4 wheeled tractors
- 4 1/4-ton utility trucks
- 5 1 1/4-ton cargo trucks
- 10 2 1/2-ton cargo trucks
- 2 5-ton cargo trucks
- 5 10-ton tractors/lowbed
- 6 chain saws
- 3 .50 cal machineguns
- 6 7.62mm machineguns

Equip & Maint Co

- 2 12 1/2-ton cranes
- 2 25-ton cranes
- 2 loaders, 5 cu yd
- 1 loader, 4 1/2 cu yd

- 2 dozers
- 2 20-ton dump trucks
- 3 5-ton dump trucks
- 2 ditching machines
- 1 75-ton-per-hour crushing plant
- 2 bituminous distributors
- 1 pneumatic tool trailer/250 cfm compressor
- 1 mine detector, metallic/nonmetallic
- 2 mine detectors, metallic
- 3 1/4-ton utility trucks
- 7 2 1/2-ton cargo trucks
- 7 1 1/4-ton cargo trucks
- 3 5-ton cargo trucks
- 3 10-ton tractors/lowbed
- 2 10-ton wreckers
- 1 skid-mounted auger
- 2 rough terrain forklifts
- 1 ditching machine

Engineer Topographic Battalion, Theater Army (TOE 5-335 H)



1 One Per Division TOE 5-540

2 One Per Corps TOE 5-540

1. **Mission:** To provide topographic support to theater elements.

2. Capabilities

a. Perform surveys and provide survey information required by the theater elements.

b. Produce revised maps, map supplements, map substitutes, overlays, overprints, photomaps, mosaics, sketches, drawings, and terrain intelligence material.

c. Maintain terrain data bases for general and special purpose graphics.

d. Interpret and measure on remote sensor imagery.

e. Plan and supervise graphic production, revision, reissue, and inventory control of maps and other graphic products. Operate the theater map supply down to division level.

f. Provide terrain information to corps and division to include prediction and analysis of the effects of terrain factors on military operations.

3. Organization

a. The engineer topographic battalion

base organization contains an HHC, a cartographic company, and a survey company. For each assigned US corps, a terrain team (corps) (team IJ, TOE 5-540) and a cartographic company (TOE 5-337) are required. Corps terrain teams are assigned to the topographic battalion and further placed in direct support of numbered corps. Also, for each assigned US division, a five-man engineer terrain team (div) (team IK, TOE 5-540) is required. Division terrain teams are assigned to parent corps terrain teams and are further placed in direct support of numbered divisions. This concept provides a habitual support relationship which allows terrain elements to move with their supported unit regardless of the supported unit's assignment or mission.

b. The HHC contains the normal staff sections and is normally located in the COMMZ along with the theater army cartographic company and terrain team.

c. The theater army and corps teams each consist of a headquarters, a collection section, an interpretation and analysis section, and an information section. The corps team is normally collocated with the corps cartographic company in support of the corps; however, a portion of the team will be collocated with the CEWI battalion to provide terrain data necessary for intelligence planning of the battlefield (IPB) analysis.

d. The corps team headquarters provides coordination with outside agencies, plans and coordinates the team activities, and maintains liaison with supported units and the division terrain teams.

e. The collection section performs the field collection effort. Its major effort is to verify reports and to compile graphic and textual data based on the needs of the command.

f. The interpretation and analysis section updates basic holdings based upon new information and makes studies and predictions based on photo interpretation, map studies, and analysis of all available information. The section has a geologist, a hydraulic engineer, two terrain analysts, a soils analyst, and two physical science assistants.

g. The information section stores data, provides limited interpretation of stored data, and disseminates overlays, special graphics, or simple type reports as needed.

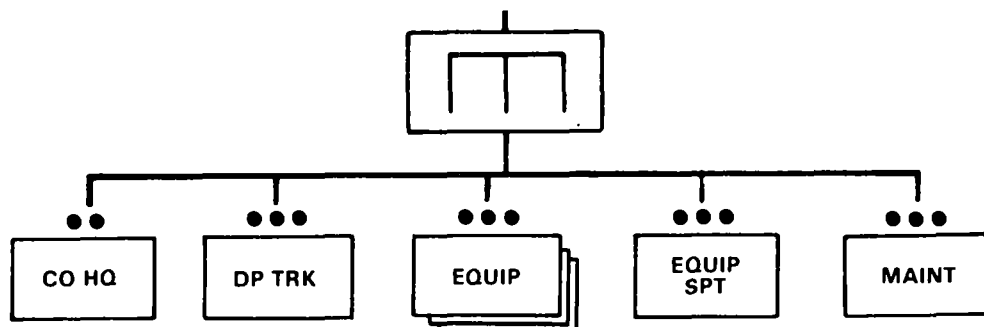
h. The division terrain team is a five-man element comprised of a terrain intelligence officer, two terrain analysts, a cartographic specialist, and a clerk-typist. The team is attached to the division. It works under general staff supervision of the G2 and under special staff cognizance of the division engineer. The element is normally collocated with the intelligence operations of the divisional CEWI battalion.

i. The team provides terrain intelligence to division and lower level commanders by evaluating information gathered from division sources or provided by the corps terrain team. The team itself has a limited terrain analysis and cartographic capability; however, it maintains close liaison and communication with the parent corps terrain team and receives support from it.

j. The division team, with the support of the corps terrain team, can provide studies and information on the effects of weather, river-crossing sites, area trafficability, hydrography, possible water point locations, and location of engineer and construction materials.

SEPARATE ENGINEER COMPANIES

Engineer Combat Support Equipment Company (TOE 5-58 H)



1. Mission.

To support engineer combat operations with manned engineer construction equipment.

2. Capabilities

a. Provide construction equipment support for from one to three engineer combat battalions engaged in general engineer construction operations.

b. Provide construction equipment support for divisional engineer combat battalions when required.

c. Possess the capability to transport 312 yards of bulk material per trip, on a single shift basis.

d. Provide two-shift operations of selected items of equipment.

3. Organization.

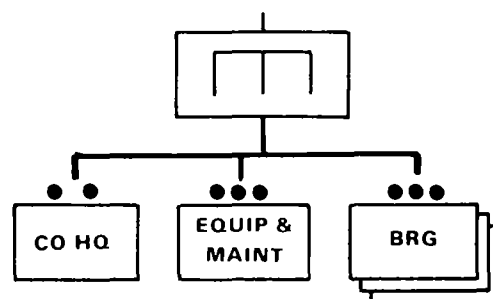
The company is organized into a company headquarters, a dump truck platoon, three equipment platoons, an equipment support platoon, and a maintenance platoon.

4. Equipment

- 26 20-ton dump trucks
- 4 20-ton rough terrain cranes
- 1 75-ton-per-hour crushing and screening plant
- 9 graders
- 9 18-cu yd scrapers
- 4 dozers
- 3 bituminous distributors
- 2 16-cu ft mixers

- 3 5-ton vibratory rollers
- 2 tractors, scoop/backhoe (CCE)
- 1 4 1/2-cu yd loader
- 3 5-cu yd loaders
- 3 pneumatic tool trailers/250 cfm compressor
- 1 self-propelled pneumatic roller
- 8 1 1/4-ton cargo trucks
- 6 2 1/2-ton cargo trucks
- 3 5-ton cargo trucks
- 1 15-ton dump truck
- 8 10-ton tractors/lowbed
- 2 1/4-ton utility trucks
- 2 5-ton tractors
- 1 10-ton wrecker
- 1 skid-mounted auger
- 2 12 1/2-ton crawler cranes
- 3 water distributors
- 3 wheeled ditching machines
- 3 pneumatic tool trailers/250 cfm compressor
- 1 detector, metallic/nonmetallic
- 2 detectors, metallic

Engineer Assault Bridge Company, Mobile (TOE 5-64 H)



a. To provide personnel and equipment to transport, erect, operate, and maintain mobile assault stream-crossing equipment in support of assault river-crossing operations.

b. To accomplish nontactical bridging or ferrying missions.

2. Capabilities

a. Erect various combinations of floating bridges or rafts to include:

- (1) One 212m class 60 bridge.
- (2) Two 117m class 60 bridges.
- (3) Three 85m class 60 bridges.
- (4) Six 40m class 60 rafts.

b. Perform engineer reconnaissance for site selection and routes.

3. Organization

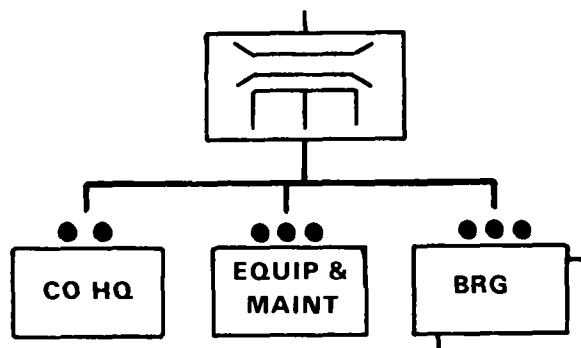
a. The company is organized into a company headquarters, an equipment and maintenance platoon, and three bridge platoons.

b. Each platoon has eight interior — and four end — bays.

4. Equipment

- 24 MAB interior bays
- 12 MAB end bays
- 1 20-ton crane
- 1 2 1/2-cu yd loader
- 1 dozer
- 4 mine detectors, metallic/nonmetallic
- 4 mine detectors, metallic
- 6 scuba sets
- 2 5-ton tractors
- 1 10-ton tractor/lowbed
- 5 1/4-ton utility trucks
- 7 2 1/2-ton cargo trucks
- 4 1 1/4-ton cargo trucks
- 1 .50 cal machinegun
- 7 7.62mm machineguns

Engineer Panel Bridge Company (TOE 5-77 H)



Engineer Panel Bridge Company

1. Mission

a. To provide personnel and equipment to load, transport, maintain, and advise on erection of panel bridging equipage.

b. To provide dump trucks for earthmoving and general hauling, when required, by immobilizing bridge loads.

2. Capabilities

a. Provide one panel (Bailey) bridge set with sufficient components and a cable reinforcement set for the erection of bridges of various spans and load classes up to one 58.5m triple truss single-story (class wheeled, class tracked) with reinforcement.

b. Provide technical supervision to assist other engineer units in erecting panel bridges.

c. Perform emergency construction of panel bridges with organic personnel at a reduced rate.

d. Possess dump truck hauling capacity of 145 tons/lift when bridging is immobilized.

3. Organization

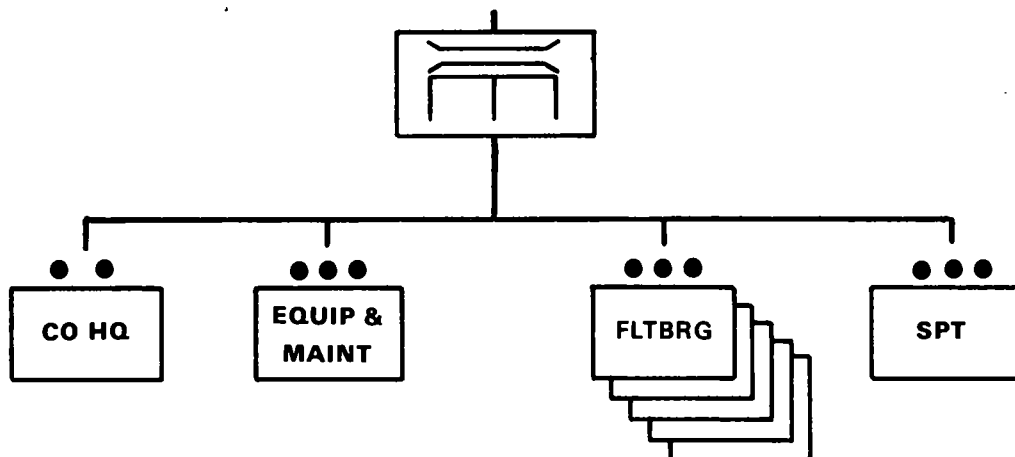
The company is organized into a company headquarters, equipment and maintenance platoon, and two bridge platoons.

4. Equipment

- 29 5-ton dump trucks

- 1 Bailey bridge set
- 2 20-ton cranes
- 1 2 1/2-cu yd loader
- 1 cable reinforcement set
- 1 dozer
- 1 welding shop

**Engineer Float Bridge Company (TOE
5-78 H)**



1. Mission

a. To provide technical personnel and equipment to load, maintain, transport, and supervise erection of tactical stream-crossing equipment.

b. General cargo hauling in emergencies by immobilizing the bridge loads.

2. Capabilities

a. Provide approximately 212 meters (700 feet) of floating bridge, or five 4-float and five 5-float rafts, or combinations of bridges and rafts when issued the M4T6 bridge.

b. Provide stream-crossing equipment to support tactical assault river crossings. The equipment includes:

(1) Seventy 15-man assault boats.

(2) Six light tactical raft (LTR) sets that provide the following options:

(a) One light floating bridge, approximately 80 meters (264 feet) long, with a maximum capacity of class 16, or,

(b) Six class 12 rafts (or ferries with the use of the ferry conversion set), or,

(c) Twenty-four pontoons, powered by outboard motors, for use in assault crossings.

c. Provide technical supervision to assist other engineer units in bridge or raft/ferry construction.

d. Perform emergency construction of bridges or rafts with organic personnel at a reduced rate.

e. Provide 5-ton stake and 2 1/2-ton cargo trucks for general cargo hauling by immobilizing bridge loads.

f. Provide two reconnaissance teams for selection and marking of bridge sites, to include underwater reconnaissance, rigging, repair, demolitions, and emplacement of antidebris and antimine booms and nets.

g. Perform nontactical bridging and rafting missions, as required.

3. Organization

a. The float bridge company is organized into a company headquarters, an equipment and maintenance platoon, five float bridge platoons, and a support platoon.

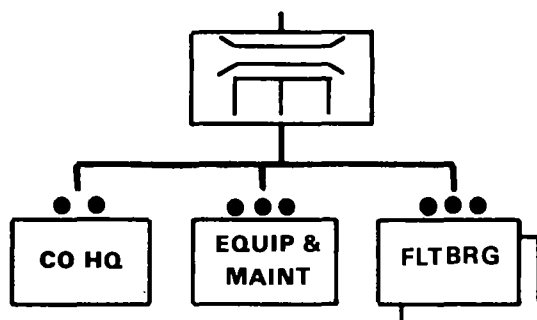
b. Each float bridge platoon has one set of M4T6 bridging.

c. The support platoon has the assault boats and the 6 light tactical raft sets.

4. Equipment

- 39 2 1/2-ton cargo trucks
- 60 5-ton stake trucks
- 70 15-man assault boats
- 5 M4T6 bridge sets
- 6 light tactical raft sets
- 24 outboard motors
- 1 dozer
- 2 20-ton rough terrain cranes
- 12 27-ft bridge erection boats

Engineer Assault Float Bridge Company, Ribbon (TOE 5-79 H)



1. Mission

a. To provide personnel and equipment to transport, assemble, disassemble, and maintain the engineer assault float bridge, ribbon.

b. General cargo hauling in emergencies by immobilizing the bridge loads and using cargo pallets.

2. Capabilities

a. Provide approximately 215 meters (700 feet) of class 60 float bridge (ribbon), or six 7-bay class 60 rafts, or any combination of bridges and rafts within the limits of the 30 interior bays and 12 ramp bays organic to the

company.

b. Provide personnel trained to select and mark bridge sites; to emplace underwater demolitions; to accomplish underwater rigging and repairs; and to install booms and nets to minimize the actions of floating mines, debris, and enemy personnel.

c. Perform nontactical bridging and rafting missions, as required.

d. Provide 5-ton stake trucks for general cargo hauling, with a 280-ton capacity per lift.

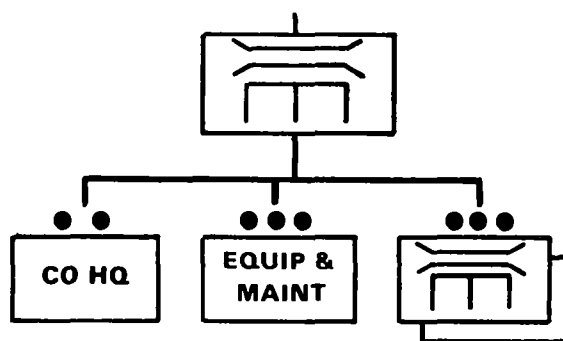
3. Organization

The company is organized into a company headquarters, an equipment and maintenance platoon and two float bridge platoons.

4. Equipment

- 30 ribbon interior bays
- 12 ribbon ramp bays
- 14 27-ft bridge erection boats
- 56 5-ton bridge transporter trucks
- 1 20-ton rough terrain crane
- 2 dozers
- 2 mine detectors, metallic/nonmetallic
- 2 mine detectors, metallic
- 5 1/4-ton utility trucks
- 2 1 1/4-ton cargo trucks
- 4 5-ton cargo trucks
- 1 5-ton wrecker
- 1 5-ton tractor
- 1 pneumatic tool trailer/250 cfm compressor
- 4 .50 cal machineguns
- 2 7.62mm machineguns

Engineer Medium Girder Bridge Company (TOE 5-74 H)



1. Mission

a. To provide personnel and equipment to transport, assemble, disassemble, and maintain the medium girder bridge (MGB) company.

b. To provide dump trucks for earthmoving and general cargo hauling by immobilizing bridge loads, when required.

2. Capabilities

a. Provide four MGB components for the assembly of various spans and load classes of single- and double-story bridges. Under normal conditions, the sets have components for:

(1) four 30.5m (100 ft) class 60 bridges.

(2) two 49.7m (160 ft) class 60 bridges with cable reinforcement kits.

b. Provide personnel and equipment to assemble two bridges simultaneously.

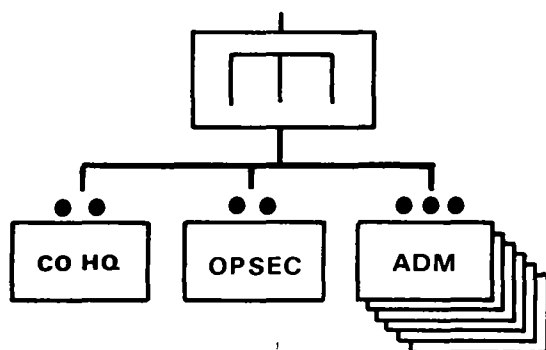
c. Provide technical supervision in emergencies to assist other engineer units in bridge assembly and disassembly.

d. Provide 5-ton dump trucks for earthmoving and general cargo hauling with a 150-ton capacity per haul when bridging is immobilized.

3. Organization

The company is composed of 4 officers and 104 enlisted men organized into a company headquarters, an equipment and maintenance platoon, and two bridge platoons.

Engineer Atomic Demolition Munitions Company (TOE 5-57 H)



1. Mission

To provide atomic demolition munitions (ADM) support to a corps, task force, and allied nations as required.

2. Capability

a. Provide supported units with technical liaison, advisory, and limited planning for employment of ADM.

b. Provide reconnaissance of ADM targets to include targets of opportunity.

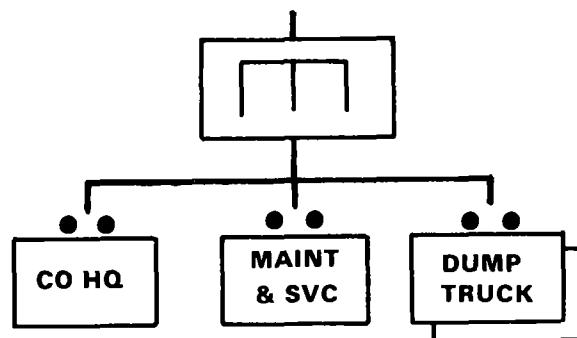
c. Prepare to fire and to detonate on order, 24 ADM and if necessary, recovery or destroy ADM.

3. Organization

a. The ADM company is organized into a company headquarters, an operations section and six ADM platoons.

b. The ADM platoon consists of four firing squads of five men and a platoon HQ of four men.

Engineer Dump Truck Company (TOE 5-124 H)



1. Mission

Operation of dump trucks for movement of bulk materials in support of other engineer units.

2. Capabilities

This unit can move 360 cubic yards of bulk materials (e.g., gravel, earth fill, crushed stone) per trip; or 600 tons of supplies and materials per trip. The amount of material that the unit can haul depends on the type of haul route, type of material being hauled,

loading-unloading facilities, and skill of the drivers.

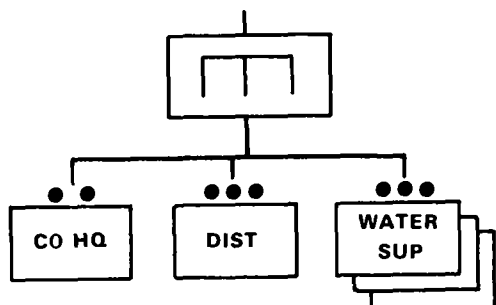
3. Organization

The dump truck company is organized into a company headquarters, a maintenance and service section, and two dump truck platoons.

4. Equipment

- 30 20-ton dump trucks
- 2 2 1/2-ton cargo trucks
- 1 5-ton cargo truck

Engineer Water Supply Company (TOE 5-67 H)



1. Mission

To produce and distribute potable water in the field.

2. Capabilities

a. Provide personnel and equipment for operating up to nine separate water supply points.

b. Provide approximately 27,000 gallons of potable water per hour of operation with organic purification equipment.

c. Provide transportation of 20,000 gallons of water from source to distribution points in one lift.

d. Perform reconnaissance for water sources, plan the location and sources, and plan the location and layout of water supply points and installations.

e. Provide limited rehabilitation and operation of civilian water supply facilities in territory under military control.

f. Provide equipment capable of removing radioactive materials from water at the rate of 9,000 gallons of water per hour.

3. Organization

The water supply company is organized into a company headquarters, a distribution platoon, and three water supply platoons.

4. Equipment

- 9 3,000-gph water purification sets
- 3 hypochlorination units
- 27 3,000-gallon collapsible tanks
- 4 3,000-gallon watertank semitrailers
- 12 1,000-gallon watertank trucks

ENGINEER UNIT ALLOCATION

ENGINEER UNIT ALLOCATION ASSIGNMENTS

A. Engineer Command and Control Elements

Unit	TOE	Category	Normal Assignment	Normal Basis of Allocation	Force Structure Active Reserve/NG	
HHC Company, Engineer Command	5-201H	III	To Theater Army	One per Theater Army	No	Yes
HHC company Engineer Combat Brigade (Army), (Corps), or (Airborne Corps)	5-101H ^a	II	To a Corps or Theater Army	One per Corps or for a command of two to four Engineer Groups in Theater Army	Yes	Yes
HHC Company, Engineer Group	5-52H ^b	II	To an Engineer Brigade	One per two to five Battalion equivalents.	Yes	Yes

a. The TOE for a single Engineer Brigade, 5-101H, will supersede 5-101G, HHC, Engineer Combat Brigade and 5-111G, HHC, Engineer Construction Brigade.

b. The TOE for a single Engineer Group, 5-52H, will supersede 5-52G, HHC, Engineer Combat Group and 5-112G, HHC, Engineer Construction Group.

B. Division Engineer Battalions

Unit	TOE	Category	Normal Assignment	Normal Basis of Allocation	Force Structure	
					Active	Reserve/NG
Engineer Battalion, Armored Division or Infantry (Mechanized) Division	5-145H	I	Organic to Armored or Infantry (Mech) Division	One per Armored or Infantry (Mech) Division	Yes	Yes
HHC, Engineer Battalion, Armored Division or Infantry (Mech) Division	5-146H	I	Organic to Engineer Battalion, Armored or Infantry (Mech) Division	One per Engineer Battalion	Yes	Yes
Engineer Company, Engineer Battalion, Armored or Infantry (Mech) Division	5-147H	I	Organic to Engineer Battalion, Armored or Infantry (Mech) Division	Four per Engineer Battalion	Yes	Yes
Bridge Company, Engineer Battalion, Armored or Infantry (Mech) Division	5-148H	I	Organic to Engineer Battalion, Armored or Infantry (Mech) Division	One per Engineer Battalion	Yes	Yes
Engineer Battalion, Infantry Division	5-155H	I	Organic to Infantry Division	One per Infantry Division	Yes	Yes
HHC, Engineer Battalion, Infantry Division	5-156H	I	Organic to Engineer Battalion, Infantry Division	One per Engineer Battalion	Yes	Yes
Engineer Company, Engineer Battalion, Infantry Div	4-157H	I	Organic to Engineer Battalion, Infantry Division	Four per Engineer Battalion ^a	Yes	Yes
Bridge Company, Engineer Battalion, Infantry Division	5-158H	I	Organic to Engineer Battalion, Infantry Division	One per Engineer Battalion	Yes	Yes
Engineer Battalion, Airborne Division	5-25H	I	Organic to Airborne Division	One per Airborne Division	Yes	No
HHC, Engineer Battalion, Airborne Division	5-26H	I	Organic to Engineer Battalion, Airborne Division	One per Engineer Battalion	Yes	No
Engineer Company, Engineer Battalion, Airborne Division	5-27H	I	Organic to Engineer Battalion, Airborne Division	Four per Engineer Battalion ^a	Yes	No

B. Division Engineer Battalions

Unit	TOE	Category	Normal Assignment	Normal Basis of Allocation	Force Structure Active	Reserve/NG
Engineer Battalion, Airmobile Division	5-215H	I	Organic to Airmobile Division	One per Airmobile Division	Yes	No
HHC, Engineer Battalion, Airmobile Division	5-216H	I	Organic to Engineer Battalion, Airmobile Division	One per Engineer Battalion	Yes	No
Combat Engineer Company, Engineer Battalion, Airmobile Division	5-217H	I	Organic to Engineer Battalion, Airmobile Division	Four per Engineer Battalion	Yes	No

a. One in augmentation.

C. Separate Maneuver Brigade Engineer Companies

Unit	TOE	Category	Normal Assignment	Normal Basis of Allocation	Force Structure Active	Reserve/NG
Engineer Company, Separate Infantry Brigade	5-107H	I	Organic to Separate Infantry Brigade	One per Separate Infantry Brigade	Yes	Yes
Engineer Company, Armored Cavalry Regiment	5-108H	I	Organic to the Armored Cavalry Regiment	One per Armored Cavalry Regiment	Yes	No
Engineer Company, Separate Armored or Infantry (Mech) Brigade	5-127H	I	Organic to Separate Armored or Infantry (Mech) Brigade	One per Separate Armored or Infantry (Mech) Brigade	No	Yes
Engineer Company, Separate Airborne Brigade	5-137H	I	Organic to Separate Airborne Brigade	One per Separate Airborne Brigade	No	No
Engineer Company, Separate Light Infantry Brigade	5-207H	I	Organic to Separate Light Infantry Brigade	One per Separate Light Infantry Brigade	Yes	No

D. Army/Corps Combat Engineer Battalions

Unit	TOE	Category	Normal Assignment	Normal Basis of Allocation	Force Structure	
					Active	Reserve/NG
Engineer Combat Battalion, 5-35H Corps,		I	To an Engineer Brigade, Corps, attached to an Engineer Group	Three per Division	Yes	Yes
HHC Company, Engineer Combat Battalion, Corps	5-36H	I	Organic to Engineer Combat Battalion, Corps	One per Engineer Combat Battalion, Corps	Yes	Yes
Engineer Combat Company, Engineer Combat Battalion, Corps	5-37H	I	Organic to Engineer Combat Battalion, Corps	Four per Engineer Combat Battalion, Corps	Yes	Yes
Engineer Combat Battalion, 5-115H Heavy		I	To an Engineer Brigade normally attached to an Engineer Group	One to four per Engineer Group	Yes	Yes
HHC Company, Engineer Combat Battalion, Heavy	5-116H	I	Organic to Engineer Combat Battalion, Heavy	One per Engineer Combat Battalion, Heavy	Yes	Yes
Engineer Equipment and Maintenance Company, Engineer Combat Battalion, Heavy	5-117H	I	Organic to Engineer Combat Battalion, Heavy	One per Engineer Combat Battalion, Heavy	Yes	Yes
Engineer Company, Engineer Combat Battalion, Heavy	5-118H	I	Organic to the Engineer Combat Battalion, Heavy	Three per Engineer Combat Battalion, Heavy	Yes	Yes
Engineer Combat Battalion, 5-195H Airborne		I	To an Engineer Brigade, Airborne Corps	One per Airborne Corps or Joint Task Force	Yes	No
HHC Engineer Combat Battalion, Airborne	5-196H	I	Organic to Engineer Combat Battalion, Airborne	One per Engineer Combat Battalion, Airborne	Yes	No
Engineer Equipment and Maintenance Company, Engineer Combat Battalion, Airborne	5-197H	I	Organic to Engineer Combat Battalion, Airborne	One per Engineer Combat Battalion, Airborne	Yes	No
Engineer Combat Company, 5-198H Engineer Combat Battalion, Airborne		I	Organic to Engineer Combat Battalion, Airborne	Two per Engineer Combat Battalion, Airborne	Yes	No

E. Corps Bridge Companies

Unit	TOE	Category	Normal Assignment	Normal Basis of Allocation	Force Active	Structure Reserve/NG
Engineer Mobile Assault Bridge Company	5-64H	I			Yes	Yes
Engineer Medium Girder Bridge Company	5-74H	II	All Corps Engineer Companies would be assigned to the Engineer Brigade, Corps, and would normally be attached to an Engineer Group.	Brigade Company Allocation is dependent upon the number and type of divisions and the area of operations. The normal allocation objective is six float bridge companies and four fixed bridge companies per type Corps. The mix of bridge companies allocated will vary as new bridge systems are introduced into the force structure.	No	No
Engineer Panel Bridge Company	5-77H	II			Yes	Yes
Engineer Float Bridge Company (M4T6 or Class 60)	5-78H	II			Yes	Yes
Engineer Assault Float Bridge Company, Ribbon	5-79H	I			No	No

F. Army/Corps Special Support and Equipment Companies

Unit	TOE	Category	Normal Assignment	Normal Basis of Allocation	Force Active	Structure Reserve/NG
Engineer Light Equipment Company, Airborne	5-54H	II	To an Engineer Brigade, Airborne Corps	Two per Engineer Brigade, Airborne Corps	Yes	No
Engineer ADM Company *	5-57H	I	To an Engineer Brigade, Corps	One per Engineer Brigade	Yes	No
Engineer Combat Support Equipment Company	5-58H	II	To an Engineer Brigade, Corps; attached to an Engineer Group	One per Engineer Group	Yes	Yes
Engineer Water Supply Company	5-67H	II	To an Engineer Command; attached to an Engineer Brigade in the COMMZ	One per 400,000 Troops	No	Yes
Engineer Construction Support Company	5-114H	III	To an Engineer Command; attached to an Engineer Group in the COMMZ	One per Engineer Group	Yes	Yes
Engineer Dump Truck Company	5-124H	III	To an Engineer Command; attached to an Engineer Group in the COMMZ	One per Engineer Group	No	Yes
Engineer Company, Port Construction	5-129H	III	To an Engineer Command; attached to an Engineer Group in the COMMZ	One per Engineer Brigade	Yes	Yes
Engineer Pipeline Construction Support Company	5-177H	III	To an Engineer Command; attached to an Engineer Group in the COMMZ	One per Engineer Group	Yes	Yes

* Divisions may be authorized organic ADM platoons in augmentation.

G. Engineer Topographic Elements						
Unit	TOE	Category	Normal Assignment	Normal Basis of Allocation	Force Active	Structure Reserve/NG
Engineer Topographic Battalion	5-305G	II	Engineer Command	One per Theater Army	Yes	Yes
HHC, Engineer, Topographic Battalion	5-306G	II	Organic to Engineer Topographic Battalion	One per Engineer Topographic Battalion	Yes	Yes
Engineer Map Reproduction and Distribution Company, Engineer Topographic Battalion	5-307G	II	Organic to Engineer Topographic Battalion	One per Engineer Topographic Battalion	Yes	Yes
Engineer Photo- Reproduction and Distribution Company, Engineer Topographic Battalion	5-308G	II	Organic to Engineer Topographic Battalion	One per Engineer Topographic Battalion	Yes	Yes
Engineer Topographic Battalion, Theater Army	5-335H	II	Engineer Command	One per Theater Army	*	*
HHC, Engineer Topographic Battalion, Theater Army	5-336H	II	Organic to Engineer Topographic Battalion, Theater Army	One per Engineer Topographic Battalion	*	*
Cartographic Company, Engineer Topographic Battalion, Theater Army	5-337H	II	Organic to Engineer Topographic Battalion, Theater Army	Four per Engineer Topographic Battalion	*	*
Survey Company, Engineer Topographic Battalion, Theater Army	5-338H	II	Organic to Engineer Topographic Battalion, Theater Army	One per Engineer Topographic Battalion	*	*
Engineer Topographic Company, Corps	5-327G	II	Engineer Brigade, Corps	One per Engineer Brigade	Yes	Yes

* The Engineer Topographic Battalion, Theater Army, TOE 5-335H, will replace the Engineer Topographic Battalion, TOE 5-305G and the Engineer Topographic Company Corps, TOE 5-327G.



Appendix C

THREAT ORGANIZATION AND EQUIPMENT

This appendix contains information on the Threat—how he is organized and the equipment he uses.

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GENERAL

The enemy - the "Threat" - has fielded a modern, highly mobile, and well balanced fighting force trained to seize and maintain a high tempo of offensive action. Even his defensive doctrine is developed as part of an overall offensive strategy. It is adopted only as a temporary expedient while awaiting an opportunity for offensive action or as an economy-of-force measure to support the overall offensive.

In the offense, the Threat advocates the concentration of numerically superior forces and firepower for a combination of frontal attack, enveloping maneuvers, and deep offensive thrusts into the enemy rear by armorheavy combined arms forces. The Threat anticipates achieving an offensive momentum which will allow his forces to advance from 30 to 50 kilometers a day in a conventional environment and from 60 to 100 kilometers a day in a nuclear environment.

The Threat adheres to certain principles which advance his doctrine of high-speed offensive action. These are to—

- Seek surprise at all times to paralyze our will to resist and deprive us of the ability to react effectively.
- Achieve mass in decisive areas by rapidly concentrating men, materiel, and fire in the minimum time necessary to rupture our defenses.
- Achieve flank security by aggressive advance.
- Breach our defenses at weakly defended positions and rapidly advance deep into rear areas.
- Bypass strongly defended areas leaving them for neutralization by following echelons.
- Launch massive artillery support to include mortars, multiple rocket launchers, antitank guns, and tanks (where necessary) for all operations, and achieve up to 100 tubes per kilometer for the deliberate attack (breakthrough) when forced to conduct such an attack.

- Conduct operations under a dense and redundant air defense umbrella.

- Dedicate a high priority to the destruction of our nuclear and antitank weapon systems.

- Employ tactical air support to achieve air superiority, and conduct air strikes in our rear areas.

- Employ radio electronic combat as a primary element of combat power.

- Accept heavy losses and the isolation of units in the assault.

- Overcome natural and manmade obstacles with utmost speed.

- Conduct operations 24 hours a day under all visibility and nuclear, biological, and chemical (NBC) conditions.

- Initiate defensive operations only to gain time or to economize forces.

Chapter 3 contains Threat offensive tactics.

Chapter 4 contains Threat defensive tactics.

COMBAT FORCE STRUCTURE

According to Threat doctrine, successful combat operations depend upon the integrated employment of all branches and services to form a combined arms force. The basic units for sustained operations are the motorized rifle and the tank divisions. These divisions contain all necessary elements to allow them to function in nuclear or nonnuclear conditions.

Units below the division level are rarely employed without reinforcements or attachments. Motorized rifle troops and tanks consistently operate together; ground operations are always supported by meticulously planned artillery fires. The unit structure is designed to be adapted readily to changing combat requirements by the attachment of large numbers of supporting units.

The Threat commander normally employs his forces in echelons, both in the offense and defense. Each tactical command level down to battalion determines from the situation the number of echelons required for a particular operation. In the offense, two echelons are normal. As a unit attacks in echelons, each with a preplanned scheme of maneuver and objective, the offensive appears to the defender to be a series of attacking waves.

The first echelon is the assault unit which attempts to rupture and pass through enemy defenses. The second echelon is the follow-up element, used to defeat bypassed enemy units and to continue or maintain the momentum of the attack.

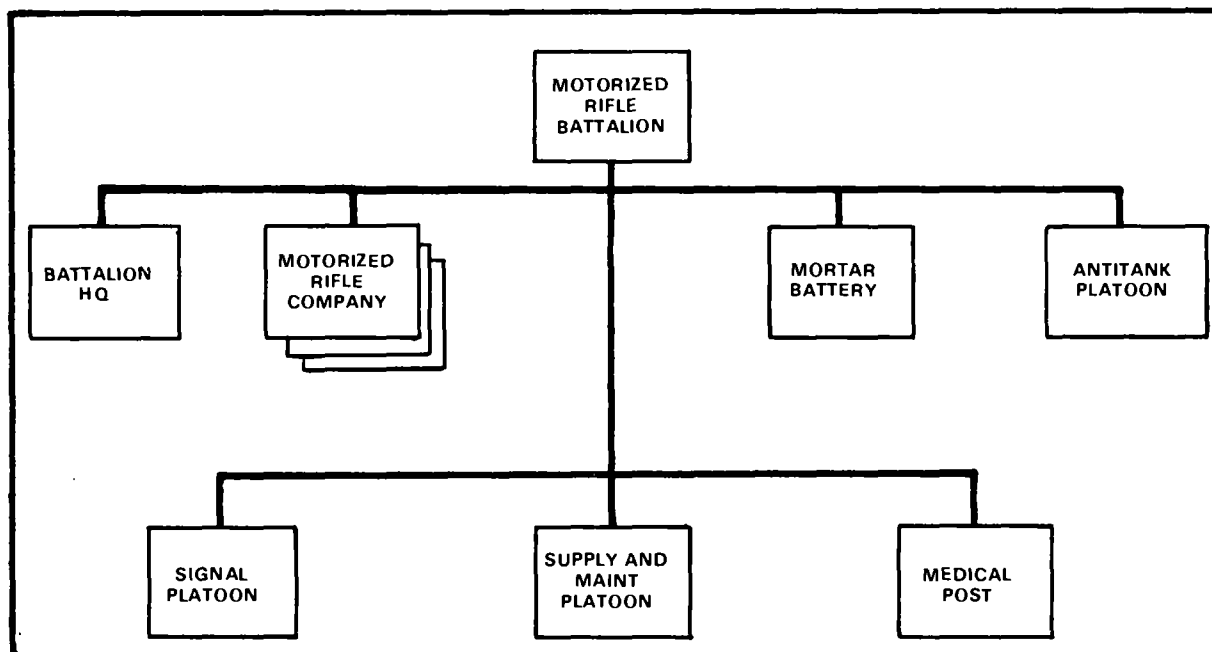
In addition to echelonment, the Threat commander normally retains a reserve which may consist of motorized rifle or tank units and reserves of artillery (antitank and air defense), engineers, chemical troops, and other type units as required by the tactical situation. The size of the reserve varies, but is relatively small. The reserve, normally heavy antitank, is considered the commander's contingency force. He uses the reserve to replace destroyed units, to repel counterattacks, to provide local security against airborne/heliborne and partisan operations, and to act as an exploitation force to influence the outcome of the operation.

THE THREAT SOLDIER

The Threat soldier the US Army is likely to face is expected to be a tough, callous opponent, inured to hardship and convinced that he is righteously defending his country against aggression. He is rigidly disciplined and trained to live and fight in the field under conditions closely simulating actual combat. His weapons and equipment are good quality and designed for simplicity and the rigors of combat. The Threat soldier's greatest personal strength, that of obedience, tends to suppress initiative, a characteristic demanded by the modern battlefield. Consequently, the US soldier and his unit probably are better trained to respond innovatively to situations calling for self-initiated action.

MOTORIZED RIFLE

The motorized rifle troops are considered by the Threat to be the basic and most versatile arm of its armed forces. Doctrine considers motorized rifle to be capable of employment under any condition of climate or terrain and at any time. Critical missions for the motorized rifle of the combined arms team are seizing and consolidating terrain in the offense and defending this terrain in the defense. The motorized rifle battalion is the basic maneuver element of the motorized rifle regiment and is organized as below.



When committed, the battalion normally is reinforced with a motorized rifle company and has the following weapons:

ANTIARMOR WPNS	INDIRECT FIRE WEAPONS
BMP 32*	120mm Mortar 6†
SAGGER LAUNCHER 34*	INFANTRY SMALL ARMS
SPG-9 2	Rifle AKM 7.62mm 356
RPG-7 27	LMG PK 7.62mm 64
TANK 13	COAX MG 7.62mm (BMP & T-62A) 45
	HMG 12.7mm TK Mtd 13
	Sniper Rifle SVD 7.62mm 9
	AIR DEFENSE WEAPONS
	SA-7 Launcher 12†

**Each BMP carries five Saggars and each man-pack launcher has two Saggars. One Sagger launcher is on each BMP and two man-pack launchers are in the antitank platoon.*

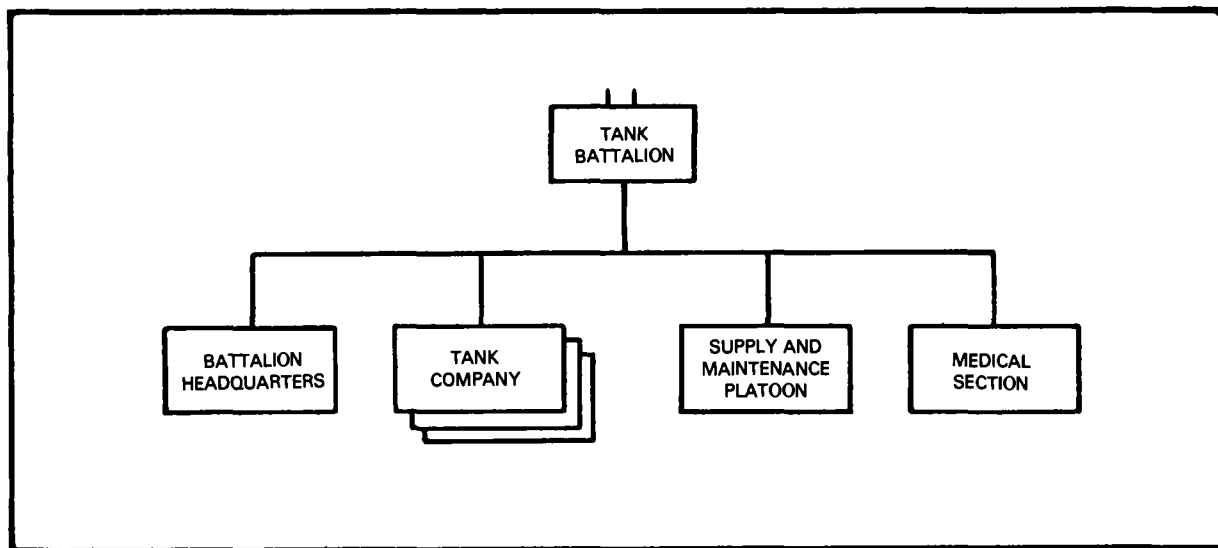
† 3 per company

TANK UNITS

Tanks are employed at all echelons. Exploitation is the principal role of Threat tanks. In the offense, tanks are often employed in mass, to seize deep objectives before the defenders are able to reorganize for

the defense or counterattack. In the defense, the majority of a unit's tanks are held in reserve to be utilized in counterattacks to destroy enemy penetrations and resume the offense.

The basic tank unit is the tank battalion and it is organized as shown below:



When committed, the battalion normally is reinforced with a motorized rifle company and has the following weapons:

ANTIARMOR WPNS		INDIRECT FIRE WEAPONS	
BMP	10	120mm Mortar	NONE
		INFANTRY SMALL ARMS	
SAGGER LAUNCHER	10*	Rifle AKM 7.62mm	212
		LMG PK 7.62mm	20
		COAX MG 7.62mm (BMP & T-62A)	41
RPG-7	9	HMG 12.7 TK Mtd	31
		AIR DEFENSE WEAPONS	
TANK	31	SA-7 Launcher	12

**One Sagger launcher and one 73mm smoothbore gun with automatic loader is mounted on each BMP. Each BMP carries five Sagers—one mounted and four in the basic load.*

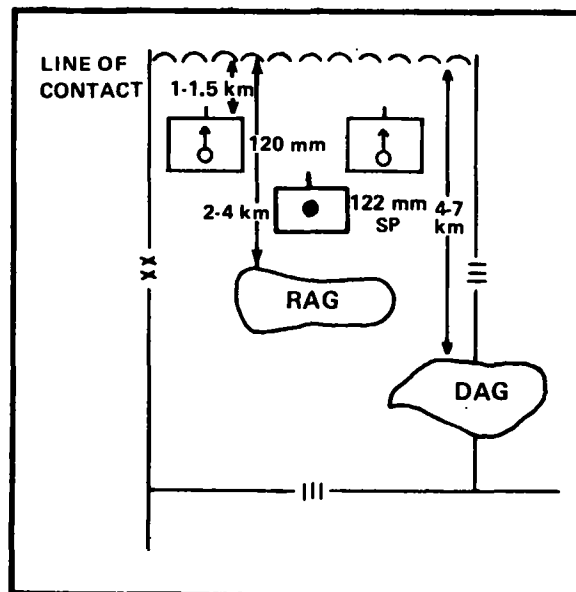
ARTILLERY

Artillery is a major component of Threat combined arms combat and is employed at all tactical echelons. Artillery weapons are employed in large numbers, and, with few exceptions, all offensives include an extensive artillery preparation. Threat artillery support is characterized by a tendency to saturate areas with massive barrages intended to insure that all likely targets are covered. Threat artillery employs the concept of "fire strike" which is a severe and intense bombardment by all artillery weapons to defeat the enemy with the minimal use of ground troops. Direct fire is extensively used on targets of opportunity and fortifications, and to support tank and motorized rifle attacks.

Threat artillery is organized for combat at Army, division and regimental level by combining organic assets with any assets from higher headquarters.

Indirect and direct fire support for first echelon battalions in the attack is provided by an accompanying battery of 122mm self-propelled (SP) howitzers and the organic

120mm mortar batteries in each motorized rifle battalion. Massive indirect fires will come from the regimental artillery groups (RAG) which consist of two to four battalions of 122mm and 152mm howitzers. The divisional artillery group (DAG) consists of two to four battalions of 130mm guns and 152mm gun-howitzers, and fires both in support of the attack and counterbattery.



Under this system of organizing for combat, it is not uncommon for a Threat division conducting a main attack to have thirteen battalions of artillery from higher command levels. These artillery battalions are in addition to the organic artillery batteries of the motorized rifle regiment(s) which are not normally placed in the RAG. It should be kept in mind that the artillery assets available to a division leading a main effort can be further augmented by the attachment of artillery organic to second echelon divisions.

The amount of fire support to be placed on a given target is dependent upon the nature of the target and relative importance. The amount of ammunition to be expended on a target is defined in terms of so many units of fire, which vary as a function of nature of target and range. At any rate, expenditures can be expected to be large when supporting a main attack.

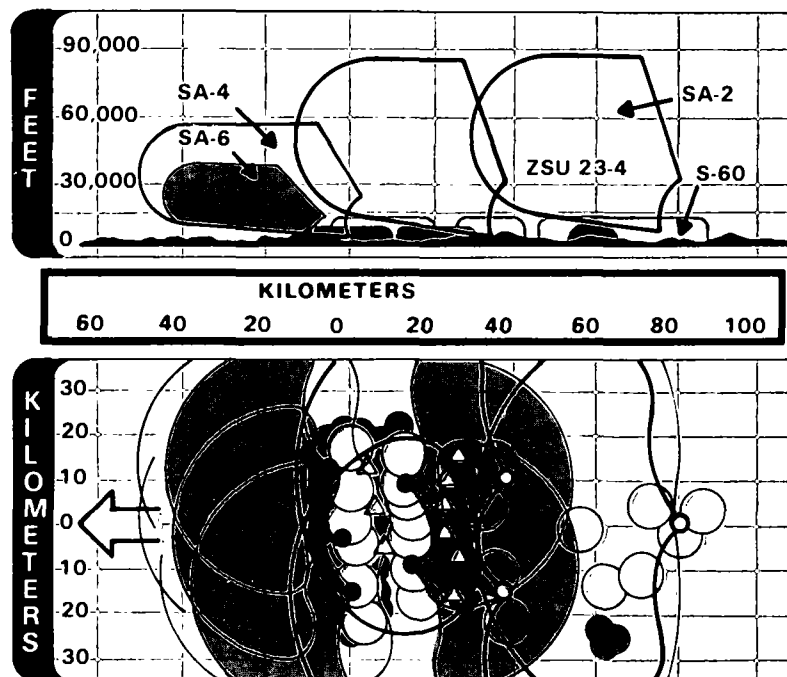
AIR DEFENSE

The Threat requirement for the air defense of its mobile formations has been met by saturating the airspace from low to high

altitude, using integrated systems of conventional weapons and surface-to-air missiles (SAMs). Threat field formations rely on vehicle-mounted SAMs and mobile guns to protect their fast-moving tank and motorized rifle units. These are augmented by interceptor aircraft of tactical air armies (TAAs) and by electronic countermeasure (ECM) units.

The mobile low altitude air defense weapons to be found in maneuver elements are the ZSU 23-4 AA gun system, the manportable SA-7 (GRAIL) and vehicle-mounted SA-9 (GASKIN) heat-seeking missiles, and the vehicle-mounted, radar controlled SA-8 (GECKO). Each of these systems is self-contained and capable of operating as a single fire unit. For medium altitude air defense, the maneuver elements are protected by SA-6 (GAINFUL) batteries, while larger formations are equipped with the SA-4 (GANEF) units for high altitude defense. The most important supply and command installation of the rear is protected by the semimobile SA-2 (GUIDELINE) and SA-3 (GOA) systems.

Air defense is established on the basis of providing zone and direct cover for troops



This figure portrays a typical Soviet Combined Arms Army air defense system, 50 kilometers wide and 100 kilometers deep. Shoulder-fired SA-7 and vehicle-mounted SA-9 launchers common to all units are not shown, but provide a dense blanket of low altitude air defense which complements the other systems.

LEGEND	
SA-2 3 Batteries	SA-4 9 Batteries
SA-6 5 Batteries	S-60 23 Batteries
ZSU 23-4 - 32 Batteries ZSU 23-2 - 19 Batteries ZSU 57-2 - 6 Batteries	

and objectives. Zone coverage is provided by the SAM systems, while point protection is provided by divisional and regimental light air defense weapons.

Air defense units will be employed to provide optimum coverage of troops as well as to protect critical support areas and division rear. Regimental air defense weapons will be employed in direct support of maneuver battalions. In addition to monitoring the air warning net, the systems receive missions from the battery commander. They are deployed well forward and their primary targets are enemy close air support aircraft and attack helicopters.

The Threat sometimes uses air defense artillery in a direct fire, infantry support and antitank role.

RADIOELECTRONIC COMBAT

The Threat may be expected to attempt systematic analysis of US Army communication and noncommunication emitters that serve as keystones upon which command and control of our forces are dependent. The enemy may then be expected to attempt to destroy or disrupt at least 50 percent of our command, control, and weapon system communications wherever possible, using suppressive fires or electronic jamming.

Direction finding of radio transmitters is not precise and the enemy's suppressive artillery fires will usually not be fired at locations provided only by direction finding. An exception is made when, due to the high concentration and wide dispersal of multiple rocket launcher fires, they can be fired against soft targets located by direction finding with a good chance of destroying the target. Suppressive fires, too, are effective against most radars since radars can be located by direction finding to within 50 meters of their actual location. Jammers also provide excellent targets for suppressive fires used in conjunction with direction finding. Otherwise, the enemy requires information from other sources to refine direction-finding locations into targets. In too many instances

this information is provided by poor signal security (SIGSEC) or poor electronic countercountermeasures (ECCM).

Threat direction finding is used to—

- Provide approximate locations of emitters suitable for firing suppressive barrages or multiple rocket fires.
- Provide precise locations of most radars and jammers.
- Provide locations which, when applied in conjunction with signal and terrain analysis, can be refined to a target area with a radius of 100 to 250 meters. This occurs mostly because of poor SIGSEC, operations security (OPSEC), and ECCM.
- Gain a picture of the battlefield with respect to the disposition and intentions of units. A single key emitter may provide such information.

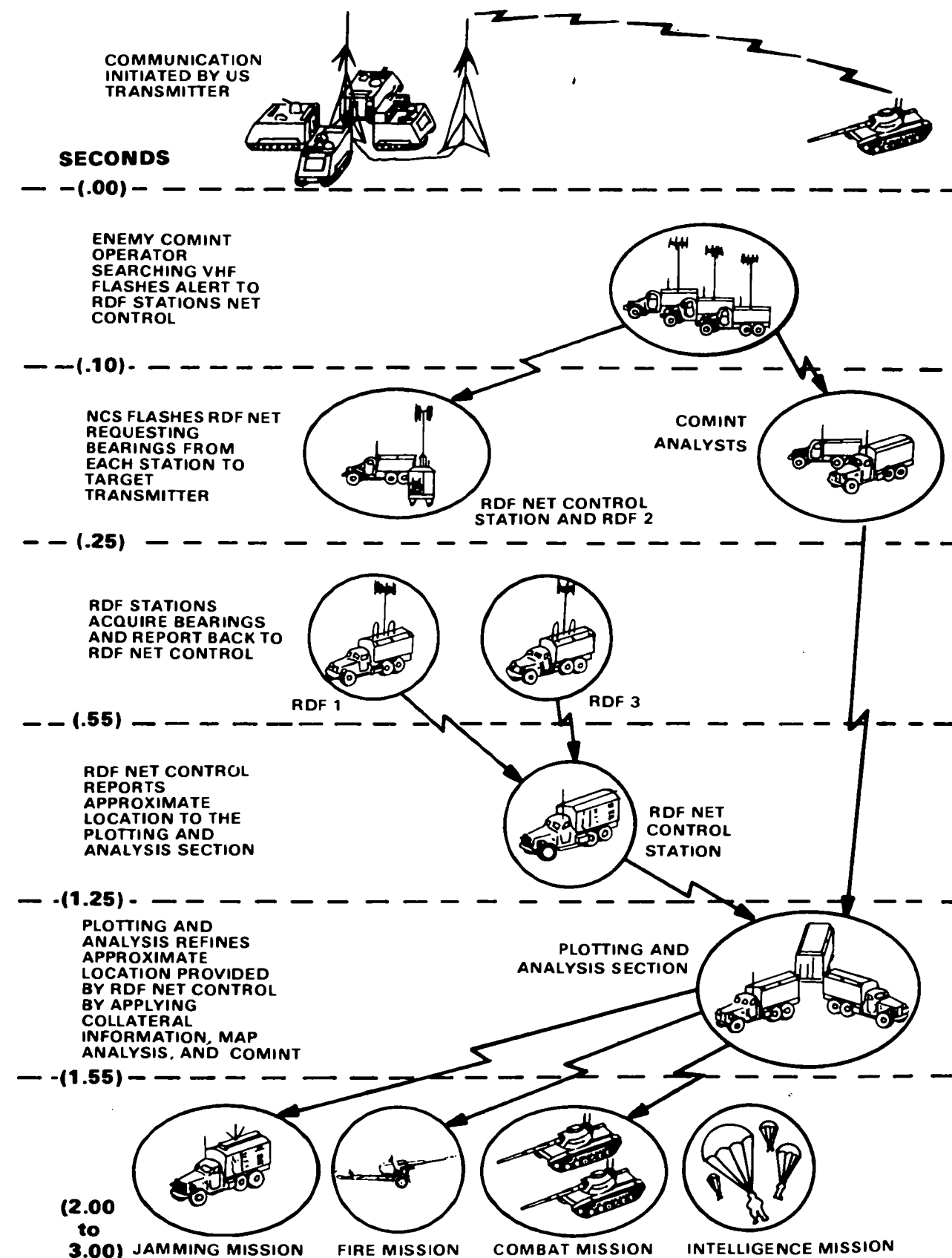
TACTICAL AVIATION

AIRCRAFT

Threat forces consider air strikes as an extension of artillery. They place the greatest emphasis in tactical air support of ground operations. Priority targets include tactical nuclear delivery systems, control posts, and command and communication elements. They also stress use of such air support and reserves within the tactical and immediate operational depths. *Threat aviation does not normally utilize high-performance aircraft to provide close air support along the line of contact. High-performance aircraft do provide close air support in certain specialized operations such as mountain operations, hasty river crossings, penetrations, and exploitations.*

HELICOPTERS

The Threat has recognized the value of helicopters in recent years. They have large heavy lift helicopters used for moving supplies. They also possess helicopters such as the HIP and the HIND which can be used to conduct both airmobile and ground support operations. Other missions for Threat helicopters include air reconnaissance and air cavalry roles.



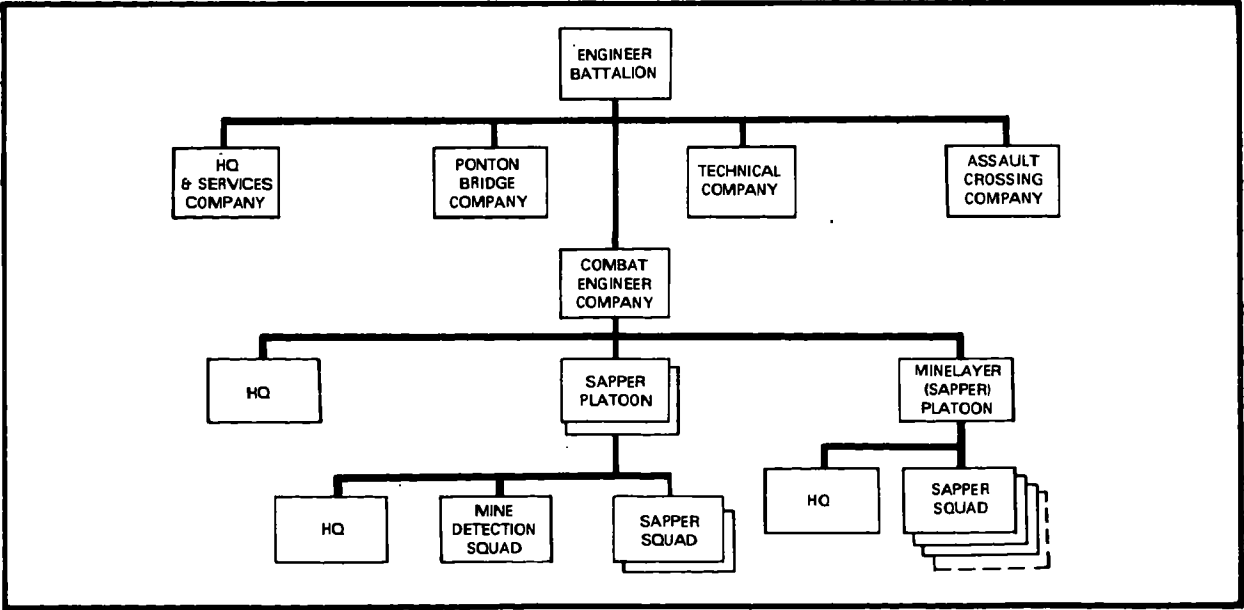
ENGINEERS

The primary mission of Threat combat engineers is to insure the momentum of maneuver mobility by rapidly overcoming obstacles, while at the same time hindering the opposing forces' movement. Secondary, but vitally important, missions include camouflage, fire protection, damage clearing, and water supply.

Engineers are an integral part of the Threat ground forces; personnel with *engineer skills are found from division down to the maneuver squad*. Engineer battalions are organic to motorized rifle, tank and airborne divisions; and an engineer company is organic to motorized rifle, tank and parachute regiments. The maneuver squads in motorized rifle and parachute companies contain a sapper who is trained in demolitions and mine warfare.

Above division, there are engineer regiments and brigades that specialize in construction, bridging, assault crossing, mapping and survey, and pipeline construction. Staff engineers are found at all echelons down to and including battalion.

The engineer battalion in a motorized rifle or tank division is organized as shown below:

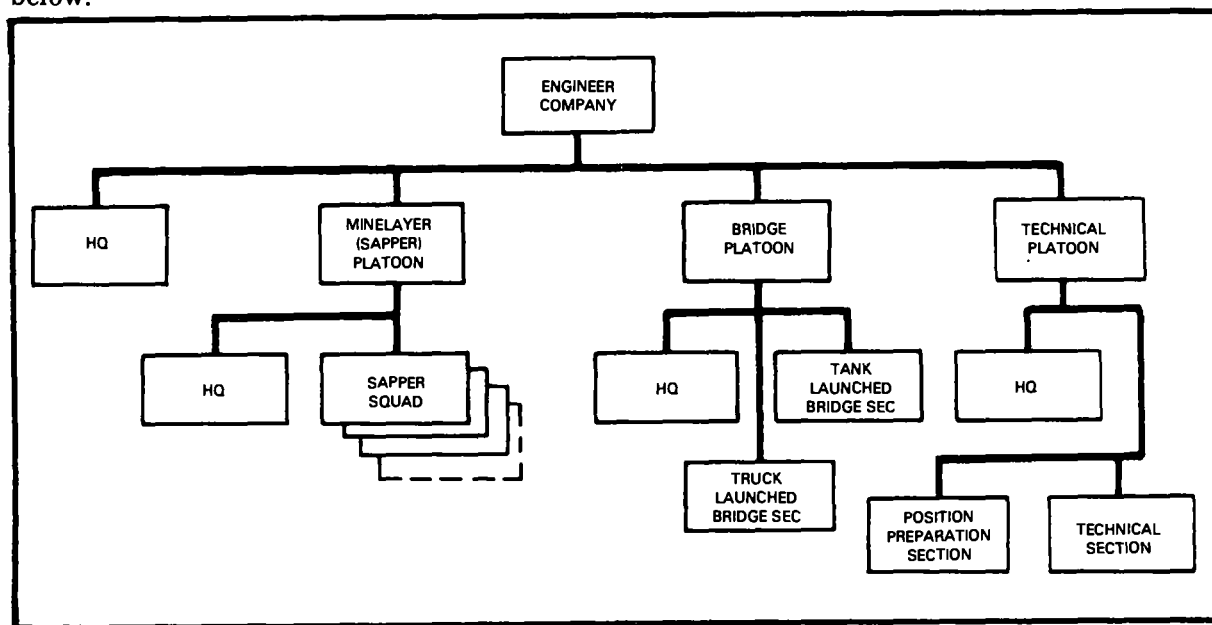


Each company in the battalion has a specific role clearly indicated by its equipment. The headquarters and services company contains the battalion staff, a reconnaissance platoon, and a services platoon (supply, maintenance, and water purification). The pontoon bridge company has float bridge equipment (16 interior and 2 end bays), trucks, and a few dozers for bank preparation. The technical company consists of graders, cranes, dozers, ditching machines, and tank- and truck-launched bridges. The assault crossing company contains heavy ferries and amphibious cargo vehicles of various sizes. The combat engineer company has armored tracked minelayers, APCs, mine detectors, and a few trucks.

The sapper platoon contains armored tracked minelayers, and sappers (demolition and mine warfare personnel) in APCs. The bridge platoon has tank- and truck-launched bridges. The technical platoon has ditching machines, dozers, and trucks.

Threat engineer units are equipped with the same small arms, tactical communications, and in many cases, combat vehicles as are the combat arms units. Engineers have the capability to fight as infantry when required.

The engineer company in a motorized rifle or tank regiment is organized as shown below:



WEAPONS

There are two attributes of Threat force weapon systems which should be well understood—mobility and mutual support. They can move on the battlefield and they all work well together. Except for the individual infantry weapons, all other Threat weapons are mounted on wheels or tracks. Anything that is too heavy to easily handle has been placed on a prime mover to provide mobility.

The Threat is predominantly armored, featuring large numbers of tanks, armored infantry fighting vehicles, self-propelled artillery, self-propelled and rapidly launched tactical bridging, and supporting mobile equipment.

TANKS AND ASSAULT GUNS

Where medium tanks are assigned:

3 per Tank Plt*

10 per Tank Co*

31 per Tank Bn*

95 per Tank Regt

215 per MR Div

325 per Tank Div

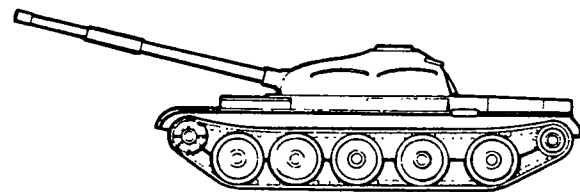
*4 per plt/13 per co/40 per bn in the tank bn of the motorized rifle regiment.

Where PT-76 reconnaissance tanks are assigned: 3 per MR & Tank Regt Recon Co; 7 per MR & Tank Div Recon Bn; and 31 per Naval Inf Tank Bn.

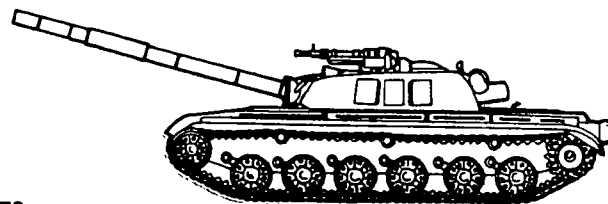
Assault guns are assigned: 18 ASU-85 per airborne division artillery element; and 9 ASU-57 per airborne regiment.

TANK CHARACTERISTICS*											
	Weight (Short Tons)	Height (M)	Length (M)	Width (M)	Speed (KPH)	Cruising Range (KM)	Armament	Slope Ascending Capability	Ditch Crossing Capability (M)	Fording Capability (M)	Vertical Obstacle Climbing Capability (M)
T-55 Med Tank	40	2.31	6.45	3.23	48	500	1X100mm 2X7.62mm	30°/50%	2.69	1.4 Snorkel-5.5	.79
T-62 Med Tank	36.5	2.36	6.71	3.33	48	500	1X115mm 1X7.62mm 12.7mm Optional	30°/50%	2.79	1.4 Snorkel-5.5	.79
T-72	38 (Est)	2.4	6.35	3.2	UNK	500 (Est)	1X115mm 1X7.62mm 1X12.7mm Optional	UNK	UNK	UNK	UNK
PT 76 Recon Tank	15.4	2.16	6.88	3.12	44 Land 10 Water	260	1.76mm 1X7.62mm	38°/62%	2.79	Amphibious	1.09
ASU-57* Assault Gun	3.7	1.22	3.35	1.83	45	250	1X57mm	39°/50%	1.40	.71	.48
ASU-85* Assault Gun	14	2.03	5.0	2.79	44	250	1X7.62mm 1X7.62mm	38°/62%	2.79	1.30	1.09

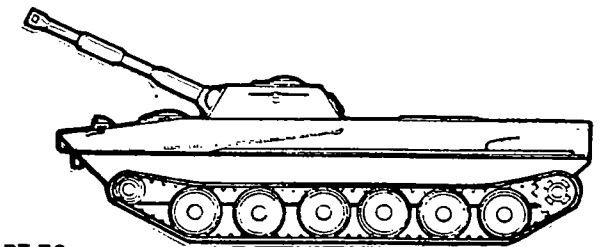
*Found only in airborne division.



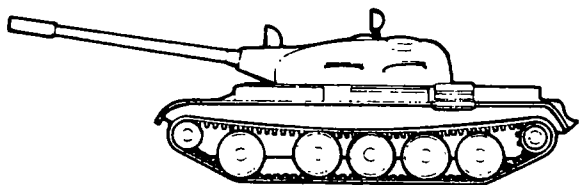
T-62



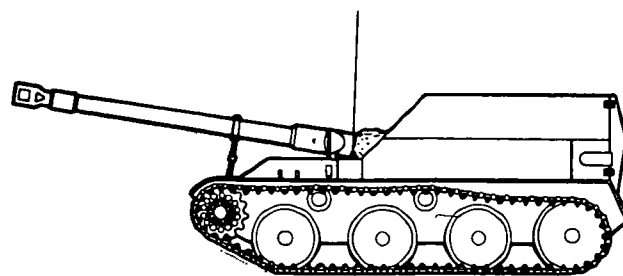
T-72



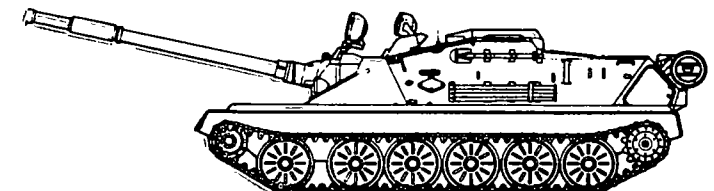
PT-76



T-55



ASU-57



ASU-85

ARMORED PERSONNEL CARRIERS

The Threat has placed all infantry personnel into armored personnel carriers. All modern APCs are amphibious. Armored personnel carriers are assigned:

3 per MR Plt

10 per MR Co

32 per MR Bn

The BRDM or BRDM-2 is used as an ATGM carrier, NBC monitoring, reconnaissance, command, or ADA vehicle. These are assigned:

1 per MR Bn HQ

4 per TK Regt Recon Ao

4 per MR Regt Regt Recon Co

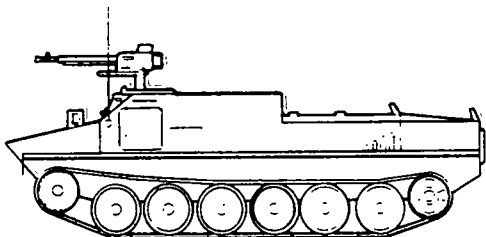
2 per MR and TK Regt Chemical Def Plt

21 per MR and TK Div Recon Bn

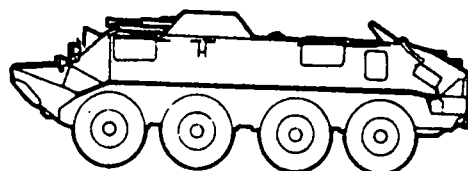
9 per MR Regt ATGM Btry

9 per MR Div TK Bn

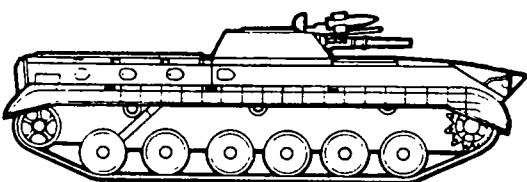
	Weight (Short Tons)	Height (M)	Length (M)	Width (M)	Speed (KPH)	Cruising Range (KM)	Armament	Slope Ascending Capability
BTP-50P	16	6.86	1.96	3.15	44 Land 10 Water	240	1X12.7mm or X7.62mm	38°/62%
BTR-60P	11	2.13	7.32	2.75	80 Land 10 Water	500	1X7.62mm PB14.5mm	30°/50%
BMP	11	1.9	6.73	2.95	60 Land 8 Water	325	1X73mm 1X7.62mm 1XAT Guided Missile	38°/62%
BRDM	6.2	1.88	5.62	2.16	100 Land 10 Water	500	1X12.7mm 2X7.62mm	30°/50%
BRDM-2	7.4	2.31	5.82	2.24	100 Land 10 Water	750	1X14.5mm 1X7.62mm	30°/50%



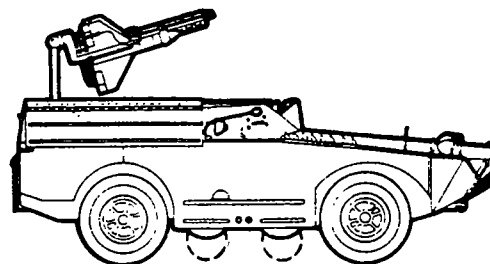
BTR-50P



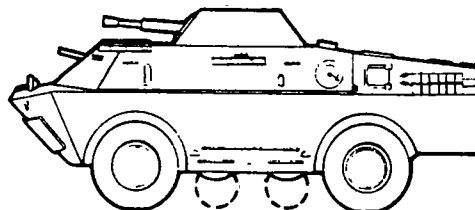
BTR-60P



BMP



BRDM



BRDM-2

	Ditch Crossing Capability (M)	Fording Capability (M)	Vertical Obstacle Climbing Capability (M)
BTR-50P	2.8	2/20	1.09
BTR-60P	1.98	2/14	.41
BMP	2.75	3/8	.92
BRDM	1.22	2/4	1.41
BRDM-2	1.22	2/4	.41

SMALL ARMS WEAPONS

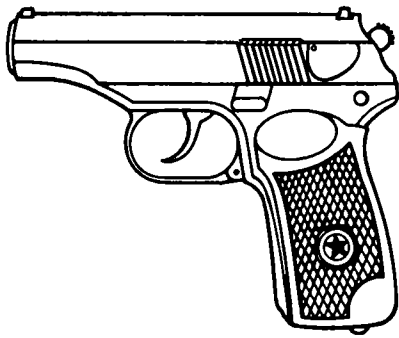
Threat small arms are characterized by their relatively heavy weight and high reliability. The automatic weapons are generally shorter than US models to facilitate use from inside APC.

A normal Threat motorized rifle platoon (BMP mounted) would have —

- 21—AKM rifles,
- 6—PKM machineguns,
- 4—9-mm pistols,
- 3—RPG-7 grenade launchers,
- 1—SVD rifle,

plus the crews of the 3 BMPs who would operate the weapons of the BMPs.

DM



AKM



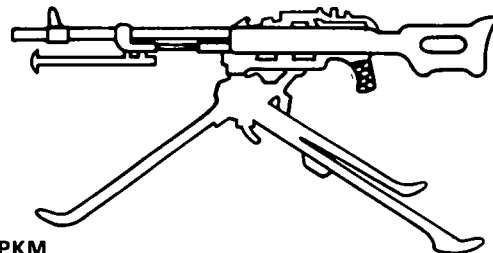
AKMS



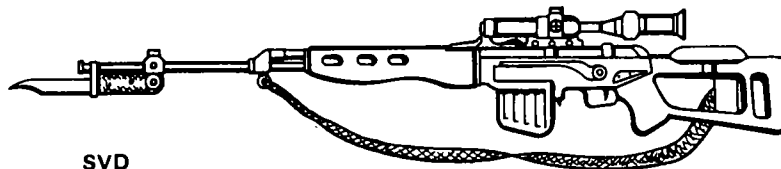
RPK



PKM



SVD



EFFECTIVE PRACTICAL RATE OF FIRE

CALIBER	MODEL	RG (meters)	(rd/min)	CAPACITY
9mm Pistol	PM	50	----	8 rds/mag
7.62mm Rifle	AKM/AKMS	300	50	30 rds/mag
7.62mm MG	RPK	800	50-150	40 rds/box 75 rds/drum
7.62mm MG	PKM	1,000	250	250 rds/belt
7.62 Rifle	SVD	800	-----	10 rds/mag

ARTILLERY

In motorized rifle divisions:

36—122mm howitzers (2 battalions)

18—152mm howitzers (1 battalion)

18—122mm rocket launchers (1 battalion)

4—FROG launchers (1 battalion)

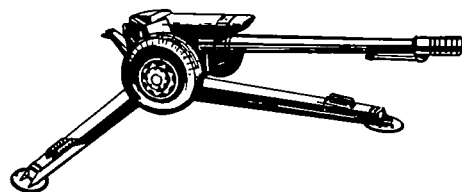
Tank divisions have 54—122mm howitzers
and no 152mm howitzers.

In motorized rifle regiments:

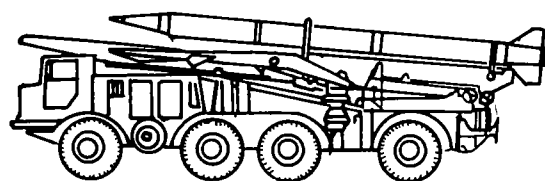
6—122mm howitzers (1 battery)

In motorized rifle battalions:

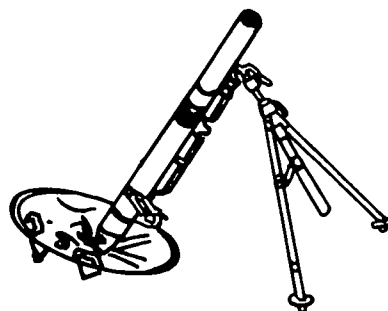
6—120mm mortars (1 battery)



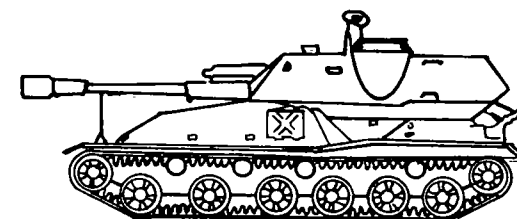
122MM HOWITZER D-30



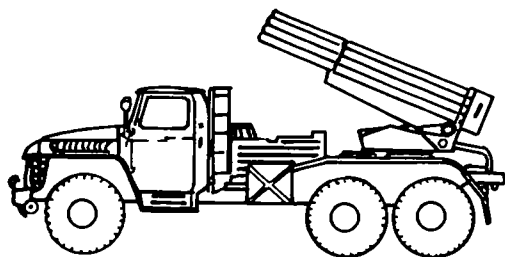
FROG-7



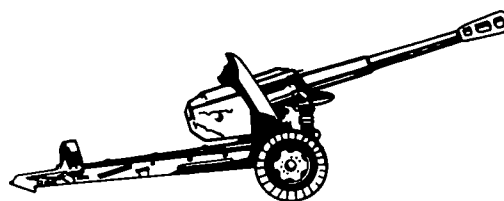
M-43/120MM



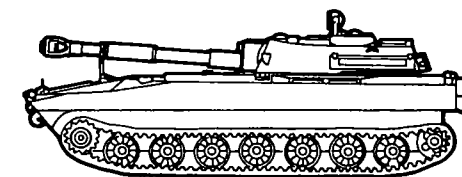
SAU-152



BM-21/122



152MM



SAU-12P

Weapon/Type Caliber (MM)	Total Weight (KG)	Projectile Warhead Weight (KG)	Max Range (M)	Rate of Fire (RDS/Min)	Crew	Normal Distance Behind FEBA (KM)	
						Offense	Defense
Mortar							
M-43/120	275	15.4	5,700	15	6	0.5	1
M-240/240	3,610	100	10,000	1	9	2	1
Field Gun							
M-46/130	7,700	33.4	27,000	5-6	9	5	9
S-23/180	20,400	102	30,000	.5	15 (est)	7	9
Howitzer							
Gun/bow							
D-30/122*	3,150	21.8	15,300	6-8	7	3	4
D-1/152	3,600	39.9	12,400	3-4	7	3	4
D-20/152*	5,500	43.6	18,500 (est)	5	10	4	5
Multiple Rocket Launcher							
BM-21/122	11,500	19	20,500	40/10	6	5	5
RM-70/122	14,000	19	20,500	40/5	6 (est)	5	5
Free Rocket							
FROG-7/500†	20,000	540	60,000	1/20		18	

NOTE:

*1. Two self-propelled weapons, 122 mm and 152 mm caliber, have entered the inventory of selected units. The 122mm is designated the SAU-122 and the 152mm is designated as the SAU-152. Range for the D-20 and D-30 apply to both self-propelled howitzers.

†2. FROG-7 minimum range is 11,000 meters. Warheads are HE, nuclear and chemical.

AIR DEFENSE ARTILLERY

Where found—

In motorized rifle and tank divisions:

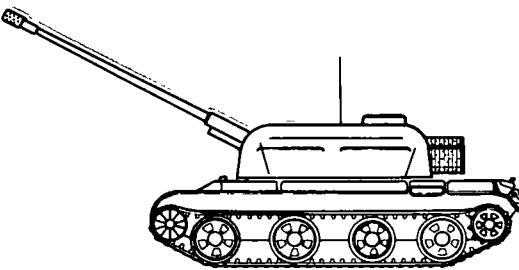
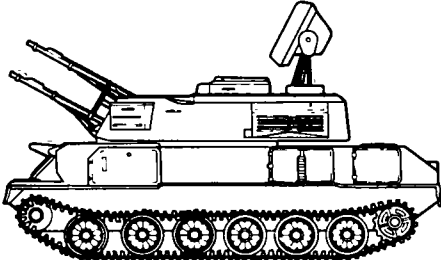
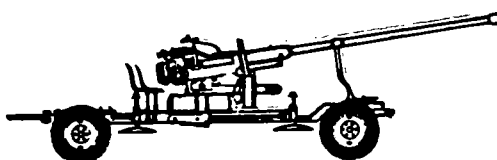
24—S-60

In motorized rifle and tank regiments:

4-ZSU-23-4 4-SA-9

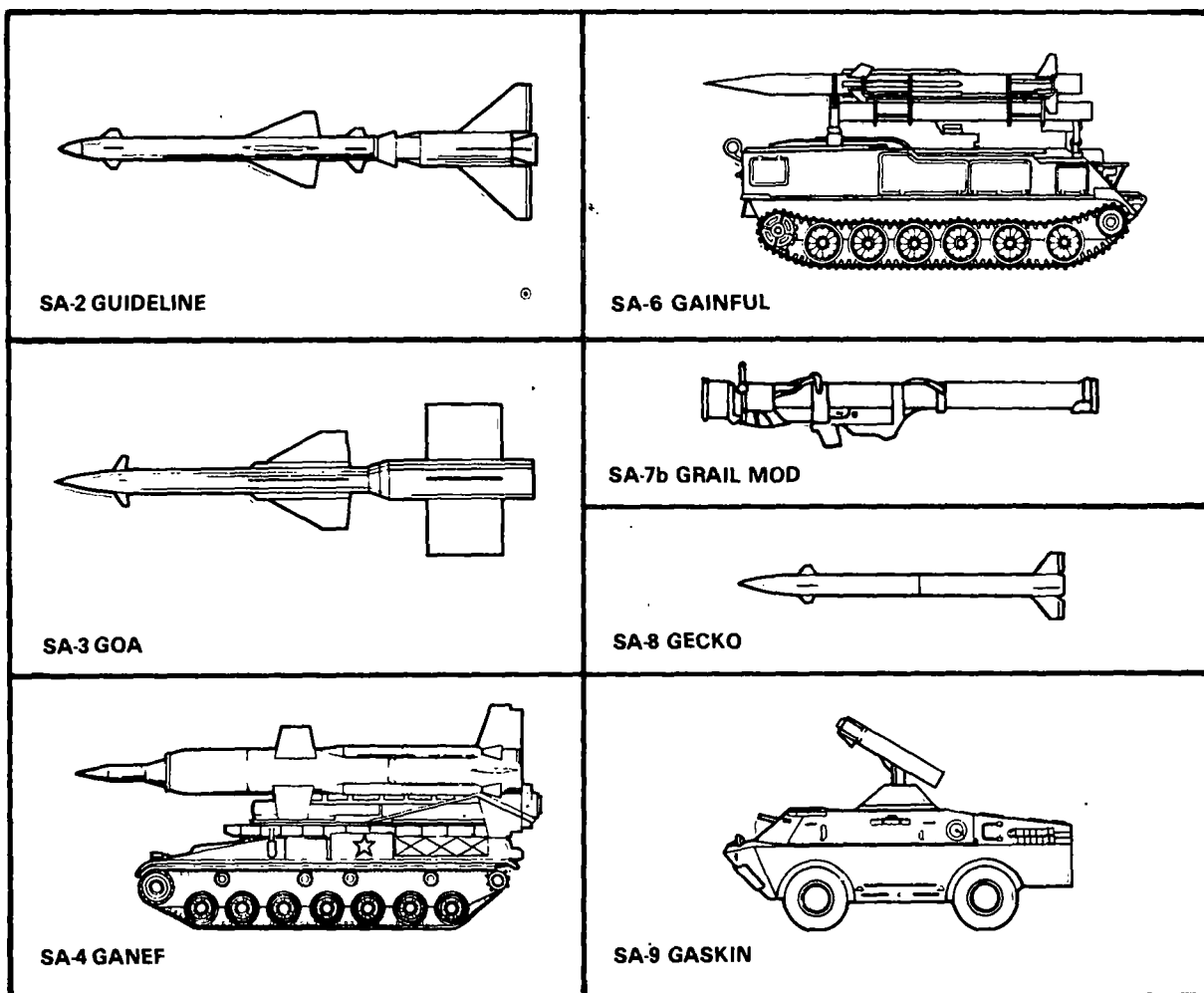
In motorized rifle and tank battalions:

9—SA-7 (3 per company)

 ZSU-57-2	 ZSU-23-4 Characteristics Length—6.25m Width—2.9m Height—2.3m Weight—14 metric tons Speed—45 kph Cruising range—263 km Ditch crossing—2.75m Vertical obstacle—1.07m Slope—30° Crew—4 men
 S-60	

**CHARACTERISTICS OF THE DEFENSE WEAPONS
ANTIAIRCRAFT GUNS**

CALIBER	MODEL	EFFECTIVE VERTICAL RANGE (meters)	MAXIMUM RATE OF FIRE (RPM)	FIRE CONTROL
23mm	ZSU-23-4	3,000/2,500	1,200	Radar or optical
57mm	ZSU-57-2	4,000	210-240	Optical
23mm	S-60	4,000	105-120	Radar or optical



SURFACE-TO-AIR GUIDED MISSILES

MISSILE	NAME	SLANT RANGE (km)	LEVEL OF PROTECTION
SA-2	GUIDELINE	45	High altitude
SA-3	GOA	22	Medium-low altitude
SA-4	GANEF	70	Medium-high altitude
SA-6	GAINFUL	30-35	Low-medium altitude
SA-7	GRAIL	3.5	Low altitude
SA-8	GECKO	10-15	Low-medium altitude
SA-9	GASKIN	7	Low altitude

ANTITANK WEAPONS

The Threat employs large numbers of antitank weapons in its motorized rifle and airborne divisions.

Antitank weapons in a motorized rifle regiment:

81—RPG-7 (1 per squad)

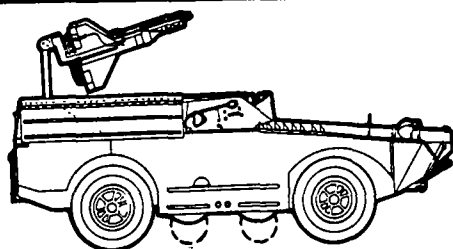
91—AT-3 SAGGER (one mounted on each BMP)

6—SPG-9 (2 battalion antitank platoon)

6—manpack AT-3 SAGGERs (2 per battalion antitank platoon)

9—ATGM vehicles (regimental ATGM battery) (1 vehicle mounts 6 SAGGER or 4 SWATTER)

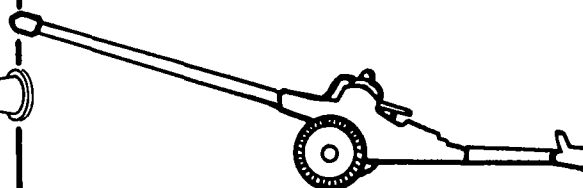
In addition the division has an antitank battalion of 18 T-12 guns.



BRDM



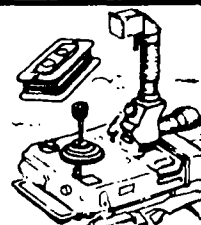
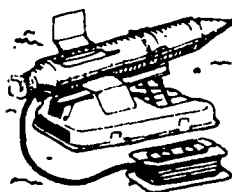
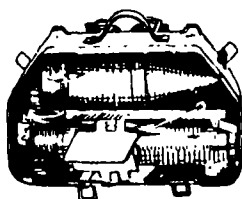
RPG-7V



T-12



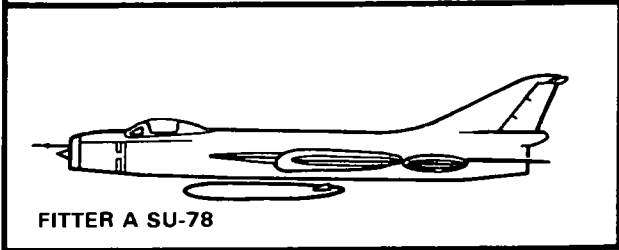
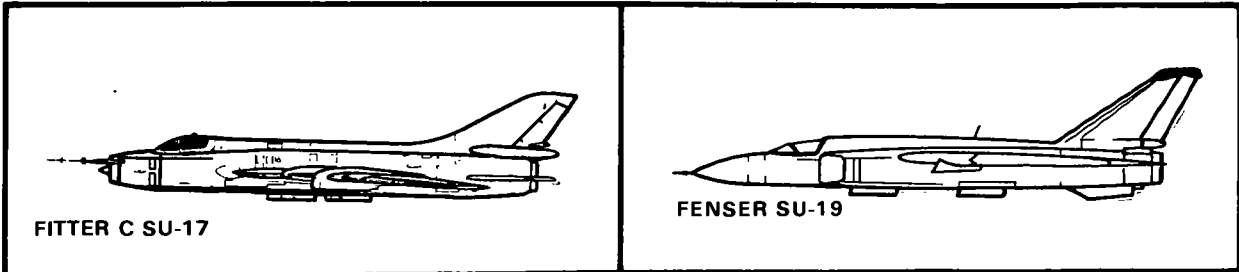
MANPACK SAGGER



MODEL	MODE	RANGE (m)	FIRE CONTROL
RPG-7V	Hand-held	300	Optical
SPG-9 73mm	Ground-mounted	1,000	Optical
T-12 100mm AT gun	Towed	3,000	Optical
AT-2 SWATTER	BRDM Helicopter	500-3,000+	Radio guided
AT-3 SAGGER	BRDM BMP Manpack Helicopter	500-3,000	Wire guided

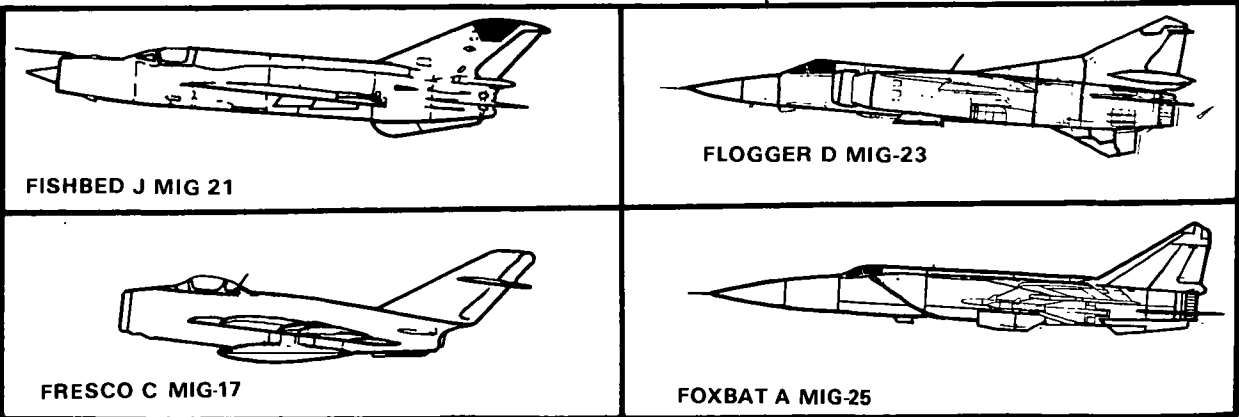
AIRCRAFT

MAIN THREAT COMBAT AIRCRAFT ATTACK	ARMAMENT-ORDNANCE				
	CANNON	EXTERNAL STORES STATIONS	BOMBS	or ROCKETS	or MISSILES
Fitter A Su-78	2-30mm	4	5	57mm/ 160mm	2 AS-7
Fitter C Su-17	2-30mm	6/8	6 HE, Cluster, HE-incendiary NAPALM	57mm/ 160mm/ 240mm	2 AS-7 Kerry AS-9
Fencer SU-19	Multibarrel 23mm	6	6	57mm	AS-7 AS-9



AIR DEFENSE ATTACK

Fishbed J MIG-21	1-23mm (Twin)	5	4	57mm/ 240mm	2AA
Flogger D MIG-23	1-23mm (Twin)	5	4	57mm	2AA
Fresco C MIG-17	3-23mm		2	YES	
Foxbat A MIG 25		4			4AA-6

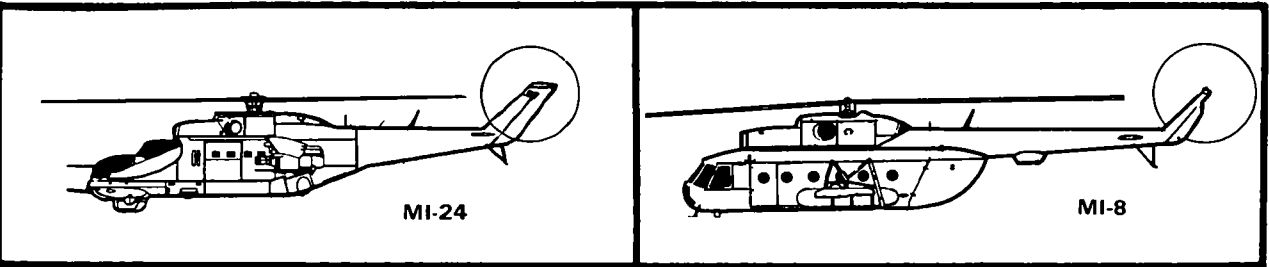


ARMED HELICOPTER CHARACTERISTICS

	LENGTH (M)	HEIGHT (M)	MAX SPEED (KMPH)	CREW	TROOPS
Mi-24	17	6	330	4	8
Mi-8	18	6	230	3	24

ORDNANCE CAPABILITIES

	CANNON	EXTERNAL STORES	BOMBS	ROCKETS	MISSILES
HIND A Mi-24	1-12.7mm MG	6	Bombs	57mm/ 160mm/ 210mm/ 240mm	4 SAGGER or SWATTER
HIP Mi-8			Possible Bombs	57mm	



ENGINEER EQUIPMENT

The PMP heavy folding pontoon bridge consists of intermediate bridge bay units and ramp bay units, with each unit mounted on a KRAZ-255B truck for transport. This bridge bay is a quadripartite pontoon made up of two bow and two center pontoon sections hinged together. The pontoon deck also serves as a roadway without additional superstructure. This ramp bay unit is similarly designed, except that the sections are tapered at one end. A system of winch, cables, pulleys, rollers, and boom attachment is built into the truck transporter for launching and retrieving bridge units.

After launching, the bridge unit is unfolded and joined with other units to form a continuous flush-deck roadway. Usually, all the units are launched simultaneously and joined together along the river bank; the assembled bridge is then turned into the

designated centerline across the river with the aid of powerboats.

Although the complete PMP set consists of 32 bridge bays and 4 ramp bays, the pontoon company in the division has a half set consisting of 16 bridge bays and 2 ramp bays.

During daylight hours use of rafts is the preferred crossing method. Various types of rafts (up to 170-ton capacity) can be constructed with the capacity determined by the number of bays.

The bays can be split in half and joined to form a 20-ton bridge. Some normal bays must be included to insure stability.

Physical Data:

Units in bridge set (nonregistered)—32 bridge bays, 4 ramp bays

Bridge bay

Weight—6790 kg
Length: Unfolded—6.75 m
 Folded—6.75 m
Width: Unfolded—8 m
 Folded—3.0 m
Depth (unfolded bow section)—0.9 m
 C Section—0.7m
 Folded—2.0 m

Ramp bay

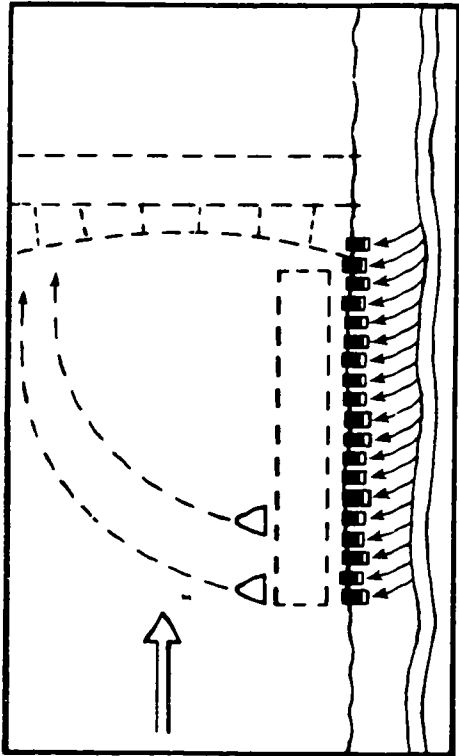
Weight—7,252 kg
Length: Unfolded—5.6 m
 Folded—5.6 m
Width (unfolded river end)—7.3 m
Shore end—7.0 m
Folded—3.1 m
Depth: Unfolded—0.7 m
 Folded—1.95 m

Bridge Assembly Data:

Bridge

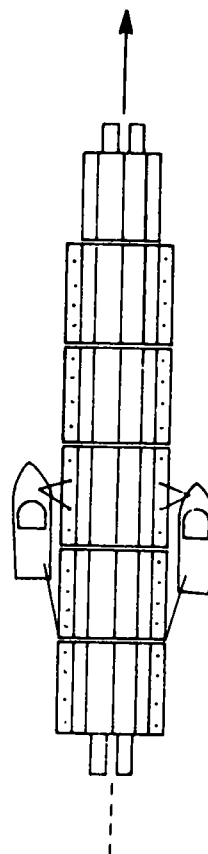
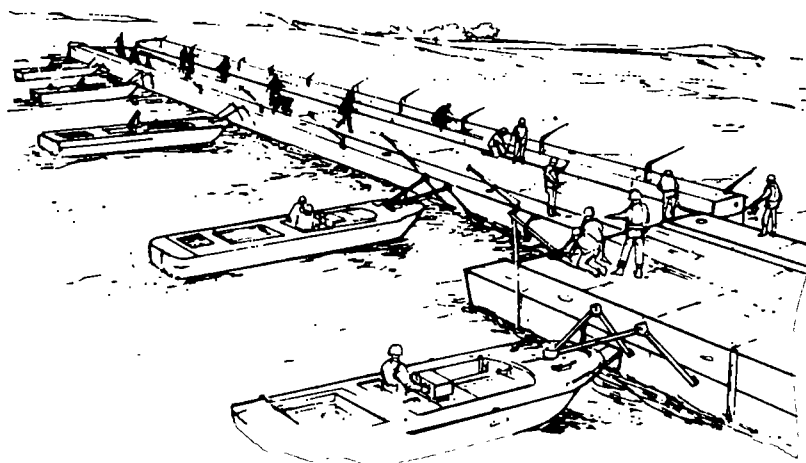
Total length—227 m
Roadway (width)—6.5 m
Carrying capacity—60 tons
Speed/Assembly—7 m/min
Working party—65 men (est)
Max stream velocity—2 m/sec

Auxiliary Equipment—12 BMK-150 or BMK-T powerboats



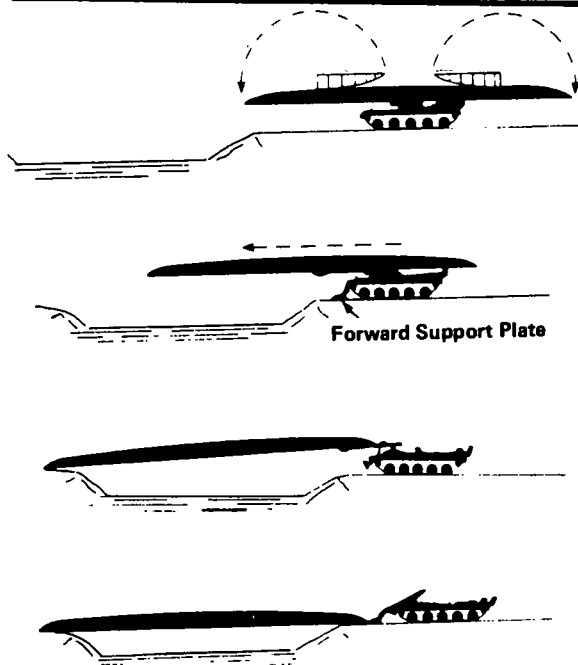
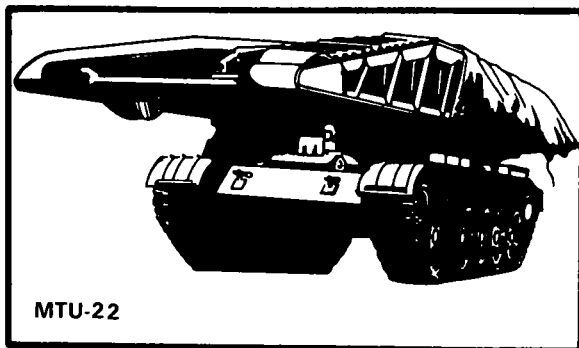
Physical Data: KRZ-255B

Weight: (curb)—11.950 kg
 Length (overall)—8.645 m
 Width (overall)—2.750 m
 Max speed loaded/road—70 km/hr
 Cruising range loaded/road—850 km
 Max gradient loaded (PCT)—57.7 in 1st gear
 Turning radius—14.0 m
 Fording depth—1.0 m
 Max towed load (kg): Off hwy—10,000 kg
 On hwy —50,000 kg

**RAFT CONSTRUCTION DATA**

RAFT TYPE (t)	RAFT LENGTH (m)	RAFTS PER SET	RAFTS PER 1/2 SET	PONTOONS PER RAFT	WORKING PARTY (men) (est)	ASSEMBLY TIME (min)
40	13.5	16	8	2	6	8
60	20.25	10	10	3	9	10
80	27.0	8	4	4	12	12
110	39.25	4	2	5 + 1 shore	18	15
170	59.6	4	2	8 + 1 shore		

D-10 Where Assigned: To the pontoon company in the engineer battalion of motorized rifle and tank division. Also found in front and army engineer units.



The tank-launched bridge mounted on a T-54 tank chassis is still located in some units.

T-54 MTU characteristics:

Length of span—12.1 m (40.3 ft)
 Width of roadway—3.6 m (11.8 ft)
 Capacity—54.5 tons (59.95 short tons)
 Height—2.5 m (3.2 ft)
 Height (bridge only)—1.0 m (3.28 ft)
 Max clear span—12.5 m (41.0 ft)
 Launching time—3 min

Where assigned: The engineer company of the motorized rifle and tank regiments and the technical company of engineer battalions have the MTU-20.

Tank Launched Bridge MTU-20

The MTU-20 (T-55 MTU) consists of a twin treadway superstructure mounted on a T-55 tank chassis for transport. Each treadway is made of a box-type aluminum girder with a folding ramp attached to both ends. Overall span length is 20.0 m.

The launching girder has three sets of dual rollers on each side of the launching frame and a forward support plate with a hydraulic cylinder. The bridge is launched hydraulically by the cantilever method; all phases of the operation are depicted in the drawing. The ramps are lowered and fully extended before the treadways are cantilevered out, with the full load of the bridge resting on the forward support plate during launch. This method of launching gives the bridgelayer a low silhouette, thus making it less vulnerable to detection and destruction.

Physical Data:

Launcher with bridge in travel position

Length—11.6 m
 Width—2.3 m
 Height—3.4 m
 Weight—37 tons
 Max speed—50 km/hr
 Cruising range—500 km
 Gap crossing capability—2.7 m
 Vertical obstacle capability—0.8 m
 Fording capability—1.4 m
 Slope—22°
 Tilt—17°

Bridge only

Length (extended)—20.0 m
 Width—3.3 m
 Height—1 m
 Weight—7 tons

Assembly Data:

Max clear span—18 m
 Width of roadway—3.3 m
 Carrying capacity—50 tons
 Time of launching—5 min
 Time-retrieving—5-7 min
 Working party/crew—2 men
 Transporter-Launcher—T-55 Tank Chassis

TMM — Truck Mounted Scissors Bridge

The TMM is a multiple-span, trestle-supported, scissors-type, treadway bridge. Each span is folded in half and mounted on a truck for transport. The treadway has a bowstring profile with the scissoring hinge joint on the curve side (the roadway is on the flat side), and the spacing between treadways can be widened from the travel position to roadway width before launching. One bridge set comprises four spans, totaling 42 meters of bridging.

The bridge is launched hydraulically over the tailgate by a launching girder mounted on the truck bed. Assisted by winch cables and pulleys, the girder raises, unfolds, and emplaces the span with the folding trestle attached. The trestle consists of two pairs of Y-shaped trestle legs, one pair on each side of the bridge. At the top, the trestle legs are fastened to a tubular transom that is fixed to the treadway sections; at the bottom, the legs are connected to the trestle shoes by a ball-and-socket joint. Each pair of trestle shoes is interconnected by two bearing plates, all hinged together. During road travel, the trestle legs are folded together and stowed beneath the treadways; during launching, the legs are first lowered to a vertical position and then spread apart by cables from the launching girder. Lengths of the trestle legs can be mechanically adjusted to give the bridge deck the desired height. The legs must be preset to their desired height prior to launching.

The TMM can be laid underwater if necessary with an approximate increase of 50% in the assembly time.

The bridge spans do not have to use the trestle fixed to the bridge, the far end will be set on the ground or all spans could be placed on preemplaced trestles.

Physical Data:

Bridge and launcher in travel position

Length—9.3 m
Width—3.2 m
Height—3.15 m
Crew—3
Max speed—55 km/hr
Cruising range—530 km
Gap crossing capability—0.96 m
Vertical obstacle capability—0.8 m
Slope—30°

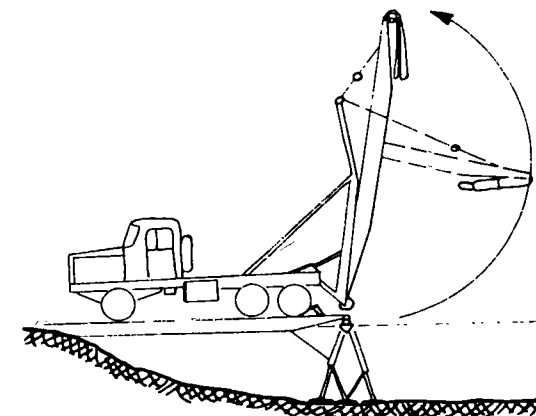
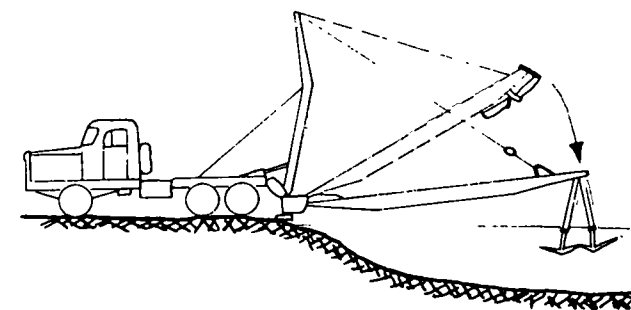
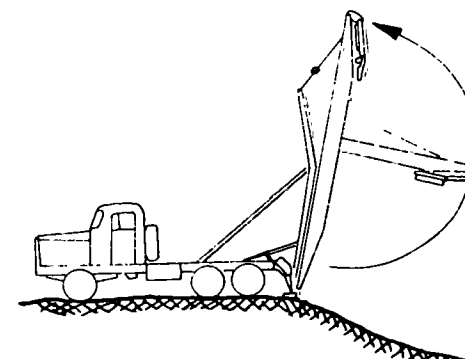
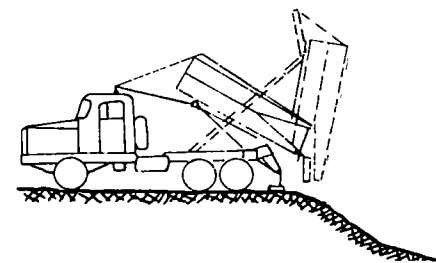
Bridge only

Weight—4.24 metric tons
Treadway (length—3.2 m folded, 10.5 m extended)
Width/treadway—1.5 m
Height/treadway
Folded—1.7 m
Extended—0.9 m
No. spans in bridge set—4

Assembly Data:

Total length of bridge—42 m (spans)
Length of span—10.5 m
Width/treadway—3.2 m closed, 3.8 m extended
Carrying capacity—60 metric tons
Height/trestles—1.7 to 3.2 m
Assembly time—20-40 minutes, day;
60-80 minutes, night
Working party—12 men (3 per span)

Where located: The TMM is located in the technical platoon of regimental engineer companies and the technical company of the engineer battalion in motorized rifle and tank divisions.

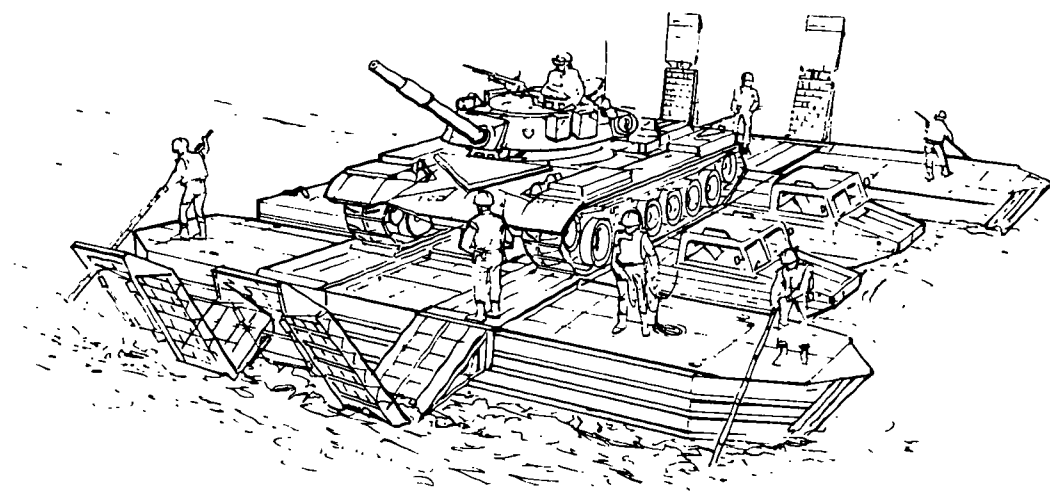


GSP — Heavy Amphibious Ferry

The ferry is built on two tracked amphibians, placed side by side and flanked by two large steel pontoons. Actually, the set consists of a left-half unit and a right-half unit which are not interchangeable. During transport, the pontoon is mounted atop the amphibian; after launching, it is lowered to the outer sides of the amphibian and locked in place. Hinges for lowering the pontoons are built into the hull on opposite sides of the amphibious vehicles. Treadways are permanently attached to the top of the decked pontoon and transversely across the gunwales of the tracked amphibians. For

loading-unloading purposes, the ferry is equipped with a scissors-type ramp extending from the outer gunwales of both pontoons. The pontoon is filled with foam plastic to make it unsinkable. The vehicle body, pontoon hull, and treadways are all built of alloy steels (chromium-manganese-silicon).

One limitation on the use of the GSP is that in places where it lowers its ramp to load or unload, the bank can be no higher than .5 meters and the water depth no less than 1.2 meters; otherwise, the ferry will be damaged. Also, the ferries cannot be joined together to form a bridge.



GSP Ferry in Operation.

Physical Data:

Units required to form a ferry—2
(left half and right half)

Unit/travel position—

Weight—17 tons

Length—12 m

Width—3.2 m

Height—3.2 m

Assembly Data:

Ferry deck-length—12 m

Width (w/o ramps)—12.6 m

Width (w/o ramps-unloaded)—21.5 m

Draft (w/o load)—0.97 m

Draft (w/load)—1.5 m

Assembly time—3 to 5 min

Working party—6

Carrying capacity—50 tons

Fuel capacity—97 gal

Fuel consumption—6 gpm

Propulsion:

Propeller—2 in each unit

Speed:

Unit on road—40 kmph

In water w/load—7.7 kmph

Where located: The GSP is located in the amphibious company of the engineer battalion in motorized rifle and tank division. There are more GSP ferries in the tank division than in the motorized rifle division.

PTS-M Tracked Amphibious Tractor

The PTS-M is a large unarmored full tracked amphibious tractor used extensively to perform numerous amphibious tasks.

In assault operations, it is used to ferry troops and cargo. In bridging operations, it is used as a floating crane, an expedient for shore deadman, and cable anchorage transporter. In ice-crossing operations, it is fitted with special attachments and used to clear lanes from broken ice. And finally, in bridge destruction operations, it is used to ferry demolition crews and equipment.

Two large three-bladed propellers provide propulsion in the water. The suspension has six large road wheels, widely spaced, with center track guides. It uses neither track support rollers nor a track support system.

The PTS-M has infrared driving and surveillance equipment, radio communication, an intercom system, and high capacity bilge pump. The cab is fully inclosed and the PTS-M is capable of operating in a nuclear and chemical environment.

The PTS-M loads through a rear tailgate/loading ramp. In addition, the PTS-

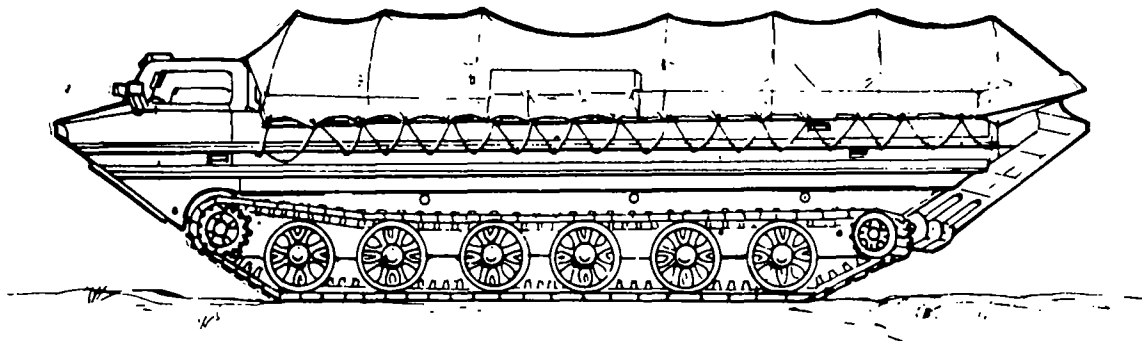
M can tow a loaded PKP amphibious trailer across a water barrier.

Characteristics:

Weight—17,000 kg (39,029 lb)
 Length—11.5 m (37.7 ft)
 Width—3.3 m (10.8 ft)
 Height (cab)—2.65 m (8.7 ft)
 Speed (cab)—40 km/h (25 mph)
 water—15 km/h (9.3 mph)
 Cruising range (land)—300 km (186 miles)
 Trench—2.5 m (8.2 ft)
 Step—0.65 m (2.1 ft)
 Slope—30°
 Crew—2
 Passengers—70
 Payload (land)—5,000 kg (11,025 lb)
 (water)—10,000 kg (22,050)

Where located: The PTS-M is found in the amphibious company of engineer battalions of motorized rifle and tank divisions. It is also found in engineer amphibious units at Army and Front level.

Remarks: The PTS-M is replacing the K-61 tracked amphibian which is still found in some units.

**Characteristics:**

Weight—9,550 kg (21,020 lb)
 Length—9.15 m (30 ft)
 Width—3.15 m (10.25 ft)
 Height—2.15 m (9.05 ft)
 Speed: (land)—36 km/h (22 mph)
 (water)—10 km/h (6.2 mph)

Cruising range (land)—260 km (162 miles)
 Ground pressure—1 kg/cm² (14.2 psi)
 Trench—3 m (9.0 ft)
 Step—0.75 m (25.6 in)
 Slope (empty/loaded)—42°/25°
 Passengers—40
 Payload: (land)—3,000 kg (6,615 lb)
 (water)—5,000 kg (11,025 lb)

Amphibious Truck, 6x6, 485A (BAV-A)

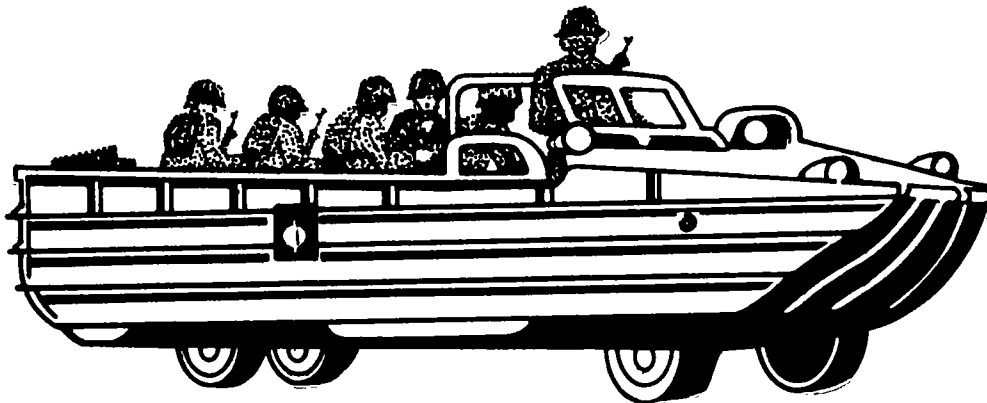
This amphibious truck is an improved copy of the United States World War II DUKW. The rear of the cargo compartment has been extended to give more space, and a tailgate has been provided for easy loading and unloading. The BAV is propelled in the water by a large three-bladed propeller located in the rear of the vehicle.

The BAV has tire pressure regulation devices to control tire pressure from the cab. In the BAV-A, the air lines are mounted internally. On an older model the BAV airlines were externally mounted. This vehicle is capable of crossing a 122mm howitzer over a water barrier.

Characteristics:

Weight—7,150 kg (12,766 lb)
 Wheelbase—3.67 + 1.11 m (144 + 44 in)
 Length—9.54 m (31.3 ft)
 Width—2.49 m (8.2 ft)
 Height—2.66 m (8.7 ft)
 Speed: (land)—10 km/h (6.3 mph)
 (water)—10 km/h (6.2 mph)
 Cruising range (land)—480 km (298 miles)
 Trench—0.6 m (1.97 ft)
 Step—0.4 m (15.8 in)
 Slope—30°
 Personnel—25
 Payload: (land)—2,500 kg (5,513 lb)
 (water)—2,500 kg (5,513 lb)

Where assigned: The BAV-A is found in the amphibious company of motorized rifle and tank division engineer battalions.



Threat Mine Warfare Methods

Tactics

All Threat combat troops are trained in the fundamentals of both offensive and defensive mine warfare. Threat forces use mines in the offense for flank protection of advancing formations to deny access to vital terrain and routes of communications as the attack advances. Mines are also laid to the rear of opposing forces as a deterrent to movement of personnel and equipment. Defense minefields are laid to slow down attacks; to control direction of movement of attacking forces into killing zones; to protect strongpoints and artillery firing positions;

and to inflict losses to equipment and personnel, especially tanks.

Minelaying Methods

Specialized sapper (engineer) units located in the division engineer battalion are charged with the responsibility of siting and rapidly emplacing effective obstacles. However, every infantry, tank, and artillery unit contains personnel who can lay a minefield without any aid. The method and actual installation of mines depend on such considerations as the type required, the time of year and condition of the ground, enemy fire and its effectiveness, the time allotted for laying, and the time of laying—at night or in the daytime.

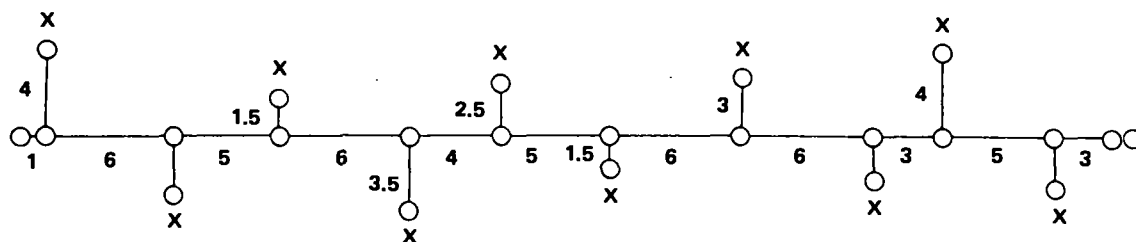
In the autumn, mines are laid, if possible, in dry elevated ground and buried shallowly under a thin layer of camouflage to assure unaffected functioning when the ground freezes. In winter, they are usually laid both in areas of snowdrifts or where drifting is unlikely. The snow is compacted to provide a base; in deep snow, however, boards, planks, or other firm supports are put underneath. On roads where the snow is compacted, the top of the mine is often set to protrude from 1.5 to 2.5 centimeters above the surface, and then camouflaged with a layer of snow.

In high grass and other forms of natural concealment and at times when enemy action compels it, antitank mines are planted without special camouflage. In hard ground they are projected about one inch above the surface; in soft ground, they are buried flush. In swampy or very loose soil, boards or other supports are put underneath. The Threat

forces avoid placing pressure type antitank mines in small depressions or other ground hollows because passing tanks may not be able to transmit sufficient detonating pressure upon them.

Dummy mines and deceptive indications of minelaying are combined with live mines. All signs of buried mines, such as fuze boxes, paper wrappings, packing crates, and spoil are removed. Particular attention is given to the camouflage of minefield travel lanes.

Mines laid by hand are positioned on the ground, using previously prepared pieces of tracing tape, wire, or cord as a gage to *space* the mines at *varying distances*. Threat forces keep elaborate records of mine locations. Later, if the mines are removed, the same tape or wire is used to locate the mines in the field. A typical spacing tape or wire might look like this:



NOTE: X denotes mine location. Numbers indicate **variable** spacing of mines in meters.

Because of the great saving in time and manpower, the Threat prefers to use mechanical minelaying equipment whenever possible. The characteristics of this equipment are given, beginning on page C-34.

Mine Density

Threat doctrine calls for about 50-100 antitank mines in each minefield with a density not to exceed 60 mines per 100 linear meters of minefield. A line of several short strips with 100-150m gaps between the strips is preferred to one long, continuous strip of mines with no gaps. The gap is intended to be slightly smaller than the frontage of an attacking tank platoon.

Threat doctrine also stresses the importance of laying minefields in depth in the directions considered most likely avenues of approach by the opposing forces' tanks. Antitank minefields and groups of antitank mines will also be located at the intersections of roads and defiles.

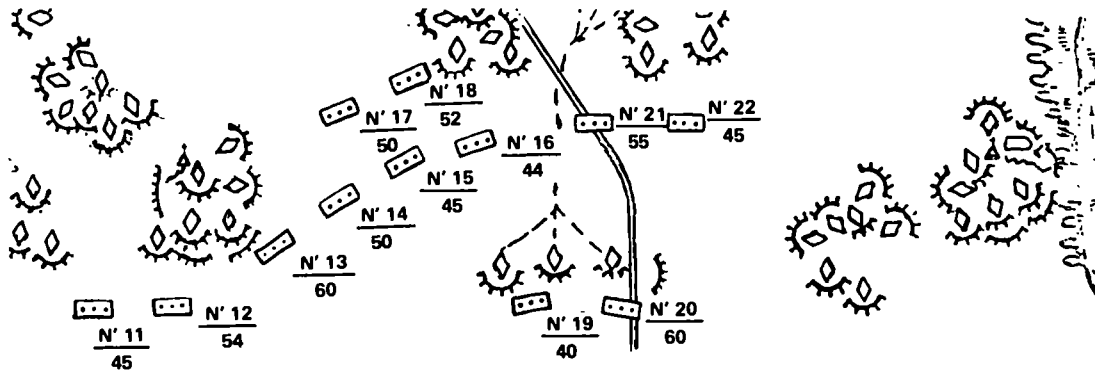
Antipersonnel mines are used for protecting antitank minefields against breaching and closing the gaps between the defense regions.

Minefield Markings

Forward area minefields normally are not marked. Rear area fields have lanes and boundaries marked by barbed wire and

signs. No rigid standard methods are used; however, blazes and paint marks are made on trees, and broken branches are left on bushes. Other devices are heaps of stones, single-stranded barbed wire fence,

small shallow ditches 5 to 10 centimeters deep, and small low wire obstacles not over 0.76 meters high. Most of these markers are located on the friendly side and along the left and right boundaries.

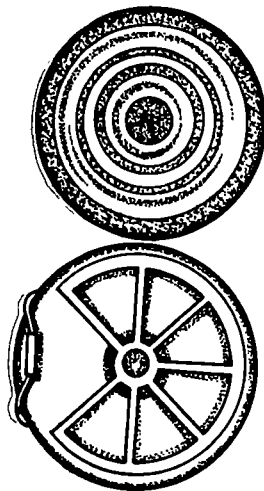


Threat Engineer preparation of defensive region for a tank battalion.

Threat forces use a vast variety of mine warfare equipment. The following is a sample of the different types of mines most commonly employed.

Antitank Mines

The TM-57 was designed for mechanical laying but can be laid by hand. The standard fuze is a delay armed-pressure fuze. When handlaid, a tilt rod fuze can be used. There is no boobytrap well on the bottom of the mine.



Characteristics:

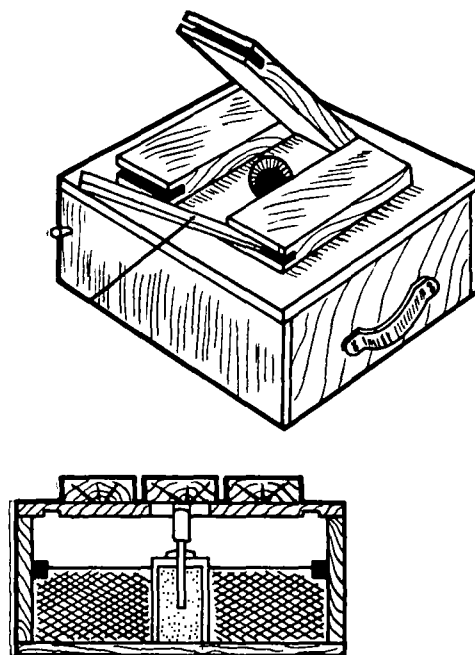
Weight—9.5 kg
Diameter—300mm
Height—100mm
Main Charge—TNT
Weight—7 kg
Operating Force—200-700 kg
Boobytrapping—Improvised

TMD-B Wooden Antitank Mine

The TMD-K is of simple wooden construction with the boards either nailed together or fastened by tongue-and-groove joints. There are three pressure boards on the cover, with the center board hinged to permit insertion of the fuze. When the mine is armed, the hinged pressure board is held shut by a wooden locking bar. The main charge normally consists of two waterproof, paper-wrapped blocks of pressed amatol, dynammon, or ammonite. The TMD-B, which may either be factory or field manufactured, employs the MV-5 pressure fuze and the MD-2 detonator. Because these mines are not waterproof, they are not suitable for permanent-type minefields.

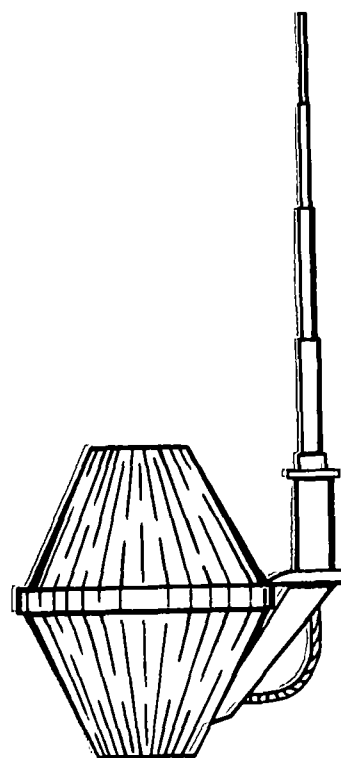
Characteristics:

Weight—7.7 kg
 Length—320mm
 Width—280mm
 Height—140mm
 Main Charge—Varies
 Weight—5-6.7 kg
 Operating Force—200 kg
 Boobytrapping—Improvised



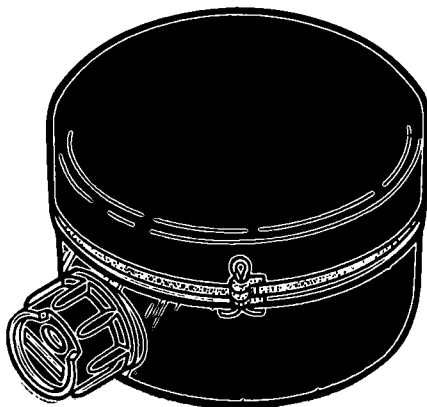
TMK-2 Charged Mine

The TMK-2 consists of a double-truncated, conical-shaped mine body with the shaped charge placed in the lower half. The mine is fitted with an adjustable-length, tilt-rod fuze which is fitted into a holder on the side of the mine. The effectiveness of the mine results from the shaped charge (HEAT) which produces a penetrating jet in the same manner as shaped demolition charges. It is designed to attack the belly of the tank where the armor is thinnest.



Antipersonnel Mines

PMN Plastic Mine

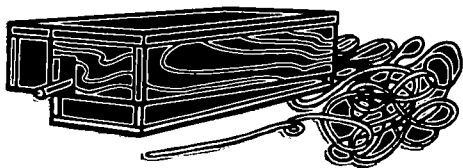


The casing of the PMN is made of duroplastic and has a side hole for the firing mechanism and primer charge. The top half of the mine case has a rubber mantle which is secured by a metal clasp. The mine is activated by pressure on the top of the case. This pressure releases a spring-loaded striker, which in turn hits the percussion cap capsule, thus setting off the main charge. On laying the mine, after removing the safety pin there is a 15 to 20 minute delay in arming. The mine cannot be disarmed.

Characteristics:

Weight—600 g
 Diameter—112mm
 Height—56mm
 Main Charge—TNT
 Weight—240 g
 Operating Force—0.22 kg
 Boobytrapping—Improvised

PMD-7 Wooden Antipersonnel Mine



Because of the ease of manufacturing and the difficulty in detection, this type of mine has remained in the Threat force inventory since early World War II. These mines employ a pull fuze. A variety of the PMD-7 uses a one-piece hollowed-out body.

Characteristics:

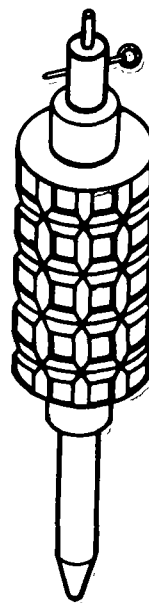
Weight—0.3 kg
 Length—150mm
 Width—75mm
 Height—50mm
 Main Charge—TNT
 Weight—75 g
 Operating Force—1 kg
 Boobytrapping—Improvised

POMZ-2 Antipersonnel Stake Mine

The PDMZ-2 uses an iron fragmentation body (like a hand grenade) with five rows of fragments. The top of the mine is threaded to receive a pull fuze. The mines are normally laid in clusters of at least four mines fitted with trip wires.

Characteristics:

Weight—1.7 kg
 Diameter—66mm
 Height w/fuze—111mm
 Main charge—TNT
 Weight—75 g
 Operating force—1.0 kg
 Bootytrapping—Improvised

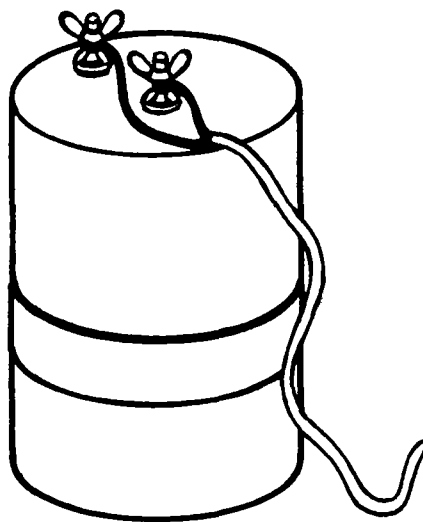


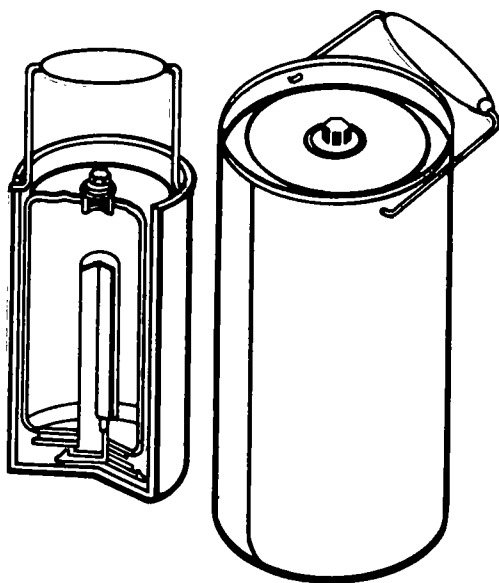
OZM-3 Bounding Antipersonnel Mine

The OZM-3 can be detonated electronically or mechanically. The electronic fuzing allows the mine to be command detonated. Mechanical fuzing is done through the use of pull fuzes, although other types, such as pressure and pull-tension release models, can be used. Of further note is the fact that the OZM-3 does not have inner and outer mine cases. On firing, the base of the mine case blows through while the rest of it bounds. The height of the explosion is determined by a tethering wire.

Characteristics:

Weight—3.0 kg
 Diameter—75mm
 Height—120mm
 Main charge—TNT
 Weight—75 g
 Operating force—0.22 kg when equipped with pull fuze
 Boobytrapping—Improvised



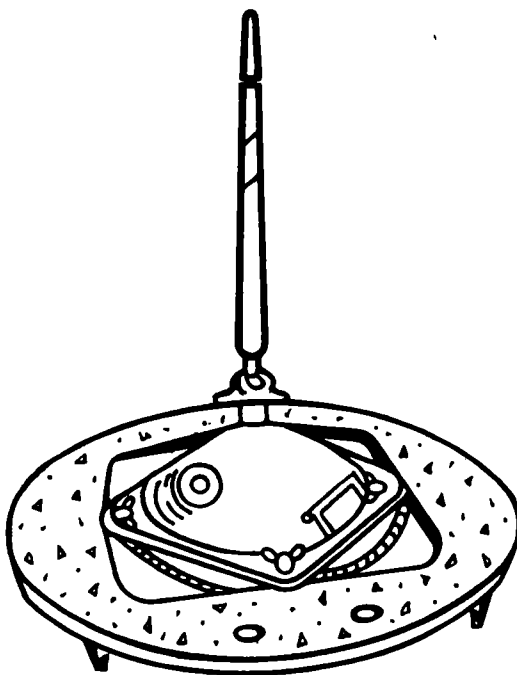


Chemical Antipersonnel Mines

Two mines, KhF-1 and KhF-2 dating from World War II are still in the Threat force inventory. The two mines, which differ only in dimensions, have steel cases filled with liquid contaminant. They are fired electrically by an observer stationed up to 300 meters distant. The firing of the electric detonator ignites the propellant, which hurls the mine upward out of the container, simultaneously igniting the delay fuze. After a delay of 1 to 1.5 seconds, the delay fuze sets off the explosive charge, shattering the mine and spreading the liquid contaminant over an area of 250 to 300 m² with an average concentration of 20 to 25 g/m².

Characteristics: **KhF-1** **KhF-2**

Weight	15 kg	15 kg
Diameter	150mm	185mm
Height	345mm	280mm
Main Charge	Tolunol or melinite	
Weight	10 g	unk
Propellant Charge	black powder	
Quantity of Agent,	4.5 liters	unk



River Mines

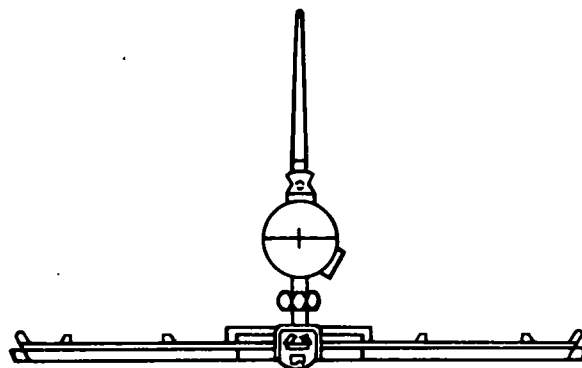
In addition to the river mines of the floating unanchored type, which are frequently designed to attack bridges as well as rivercraft, the Threat force uses specially designed rivermines to attack landing craft and amphibious vehicles. These mines, which are emplaced, rather than free floating, are divided into two types. These are the bottom mines, called PDM "antilandings mines," and the YaRM "anchored river mines." Both classes are intended to be placed in lakes, or in streams with a maximum velocity of 1.5 m/s. They also can be used on seashores with water depths ranging from 1 to 5 meters.

The PDM-6 is a hemispherical case resting on a concrete base. It has three fuze wells and an additional fuze well on the bottom of the mine for an antidisturbance device.

The tilt-rod fuzes installed in the three fuze wells can be adjusted so that the mine will fire immediately on contact, or can be adjusted to three other settings — from 20mm to 500mm — where a rod deflection will trigger the explosion.

The YaRM anchored mine is spherical in shape and uses a single tilt-rod fuze. It must be placed in water with a depth of from 0.1 to 0.7 meters, measured from the surface to the anchoring grid. Maximum permissible stream velocity is 1 m/s. Minimum distance between the mines is 12 meters.

Characteristics:	PDM-6	YaRM
Weight	47.5 kg	15 kg
Height	250mm	900mm
Diameter	500mm	300mm
Base diameter	1,000mm	unk
Main charge	TNT + PETN	
Weight	28 kg	unk



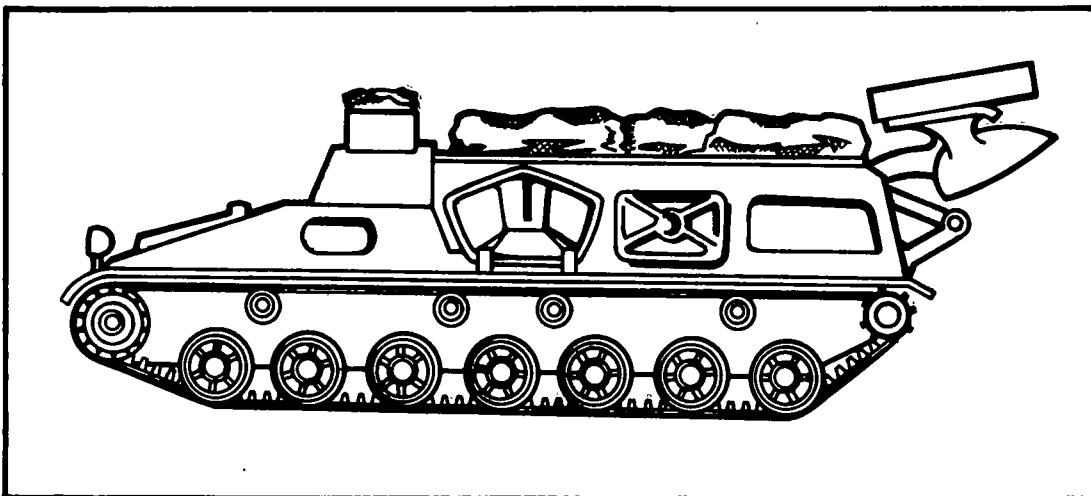
ARMORED TRACKED MECHANICAL MINELAYER GMZ

The new armored tracked mechanical minelayer uses the same basic chassis as the light tracked armored vehicle which is used to carry and launch the SA-4 "GANEF" surface-to-air guided missile. The forward location of the engine allows sufficient space in the rear of the vehicle for the mine plow mechanism and mine stowage racks. The actual minelaying mechanism is similar to that of the PMR-3, but it is not trailed. Unlike the PMR-3, the new minelayer has the tactical advantage of being able to be employed under fire. In addition, the use of the tracked vehicle gives it greater cross-country ability. This vehicle is frequently armed with a 14.5mm KPVT heavy machinegun. The vehicle is equipped with infrared night driving and other vision aids so that it can operate and lay mines at night.

Characteristics:

Length: plow in travel position—10.3 m
 plow in work position—9.1 m
Width—3.2 m
Height—2.7 m
Max speed—Unknown
Cruising range—Unknown
Trench crossing capability—Unknown
Vertical climbing capacity—Unknown
Fording capability—Unknown
Line spacing—4-6 m
Crew—4

Where found. The combat engineer company of the engineer battalion of MR and tank divisions, and the engineer company of MR and tank regiments.



MECHANICAL MINELAYER PMR-3

The PMR-3 mechanical minelayer was the first standard Threat model which could bury the mines as well as lay them on top of the ground. Normally, the PMR-3 is towed by a modified BTR-152 wheeled armored personnel carrier which has stowage racks for 120 antitank mines of the TM-46 or TM-57 types. In addition to the driver of the armored personnel carrier, the PMR-3 has a crew of three men—the two mine feeders and the operator who rides the PMR-3. The operator selects the minelaying interval by a selector lever and also controls the choice of open or buried laying.

Characteristics:

Length—3 m (9.9 ft)

Width—2 m (6.6 ft)

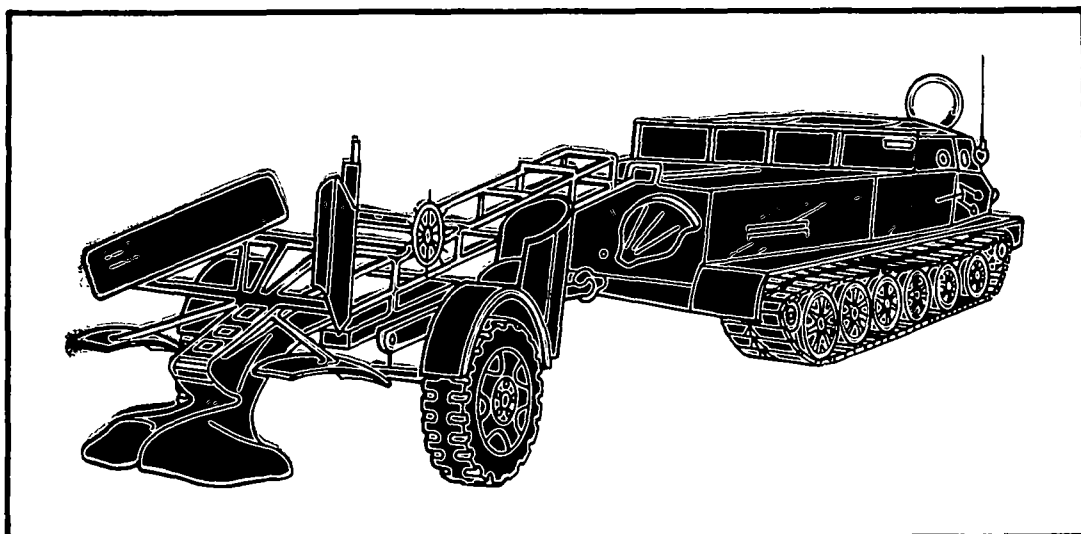
Height—2.5 m (8.2 ft)

Tire size—7.50 x 20

Mine spacing—4 or 5.5 m

Burial depth (soft soil)—30 to 40 cm (11.8 to 15.8 in)

Where found: May still be in some regimental engineer companies or combat engineer companies in division battalions.



MINE DISPENSING CHUTES

The chutes were designated for use before the mechanical mine layers came into the inventory. The chutes are still available for use.

This mine distributor consists of simple chutes hung over the sides of the vehicles which carry the antitank mines. The space between the antitank mines on the ground is determined by the speed of the vehicle and how rapidly the crew can place mines in the chutes. This mine layer is intended to be used by retreating forces when hastily placing mine barriers in light scrub land. The under-

growth hides the mines from observation. Similar chutes are used with helicopters. The Mi-4 (HOUND) is well suited for this purpose and can carry approximately 200 antitank mines. The mines are sown by a chute attached to the side of the aircraft.

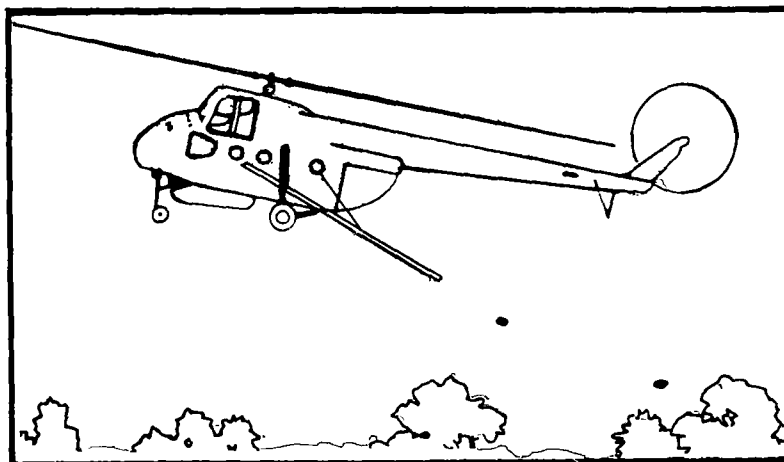
Characteristics:

Length (laying device only)—4.8 m (15.8 ft)

Width (laying device only)—40.6 cm (16.1 in)

Height (laying device only)—12.7 cm (5 in)

Laying rate per chute—4 mines per minute



UMIV-1 MINE DETECTOR

The handcarried metallic mine detector consists of a battery pack, detector assembly, search handle, search head, and headset. The detector works on the beat frequency oscillator principle and can detect large

metallic mines buried at a depth of 457mm. It can work under water.

Controls—Tone regulator is located on upper search handle

Carrying Case—One for power supply, one for spare parts

Total Weight—6.6 kg

Characteristics:

Detector Head Assembly—22 cm long, 14.6 cm wide

Search Handle—Two pieces 66 cm long, four pieces 130 cm long

Tuning Box—Mounted in search handle containing two single-tube oscillators

Power Supply—Case contains 3-volt filament supply and 70-volt plate supply

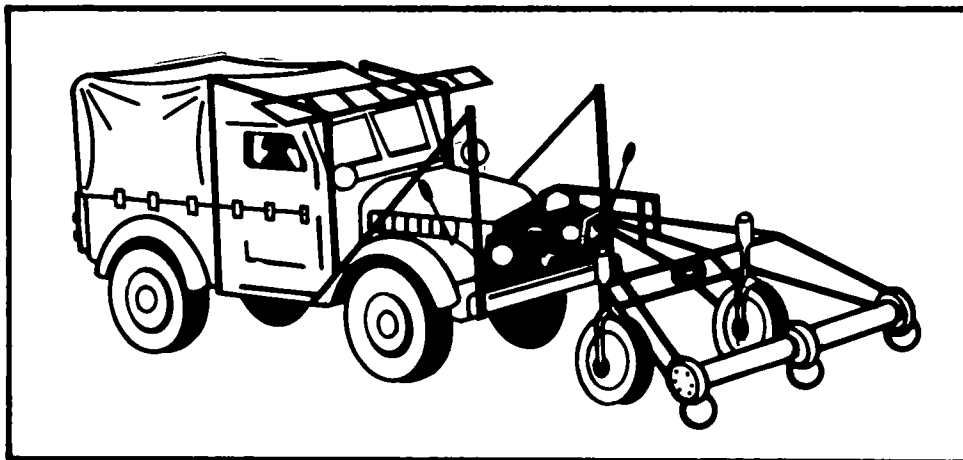


DIM MINE DETECTOR

The DIM "road induction minesweeper" consists of a UAZ-69 truck modified to mount a nonmagnetic sensing head which is supported by a frame attached to the front bumper. Its primary role is to detect mines laid in roads or on airfields. Its cross-country usefulness is limited.

During travel the detector is rotated upwards and rearwards. During operation the

detector is lowered and rests on two rubber-tired wheels. While operating, the detector can be set to operate in the center or to the right or left positions. Maximum operating speed of the vehicle is 10 km/h. On detecting a mine, the vehicle is stopped automatically. Maximum detection depth is 25 cm, or 70 cm in fords. The width sweep is 2.2 meters. The DIM has a crew of two.



IMP MINE DETECTOR

The IMP mine detector is a lightweight, all transistorized model capable of detecting metallic mines and mines that have metallic fuzes. The IMP also has an underwater detection capability of up to 1 meter. The detector set consists of a tuning box (amplifier), battery pack, headset assembly, and a detector carrying case. The amplifier system consists of five transistors and related components which are mounted in a lightweight metal box. The search assembly consists of two transmitting antennas and a receiving antenna. The search handle consists of four tubular aluminum sections which can be joined together by screws.

Characteristics:

- Detector Head Assembly—41.7 cm long, 3.8 cm diameter, encased in bakelite
- Search Handle—Four-piece, 138 cm long
- Tuning Box—Combined with battery pack, contains 5 transistors
- Power Supply—Four 1.6-volt batteries

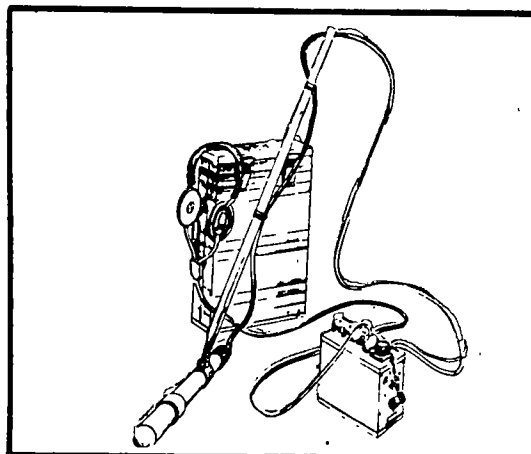
Controls—Tone regulator is located on top of tuning box

Aural Indicators—Headphones

Carrying Case—Disassembled detector and tuning box carried in lightweight metal case

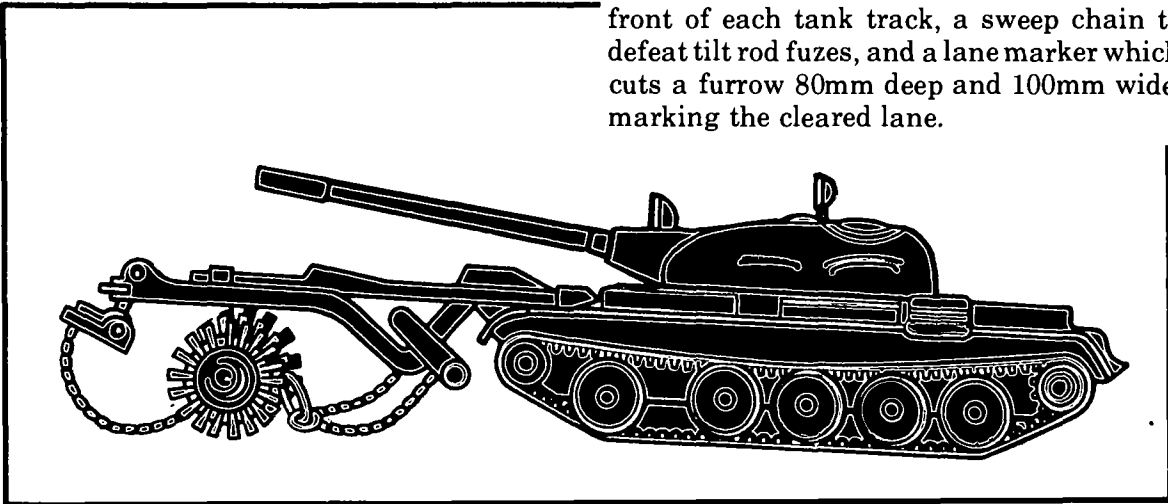
Detector Weight—7.2 kg

Extra Parts Weight—2.6 kg

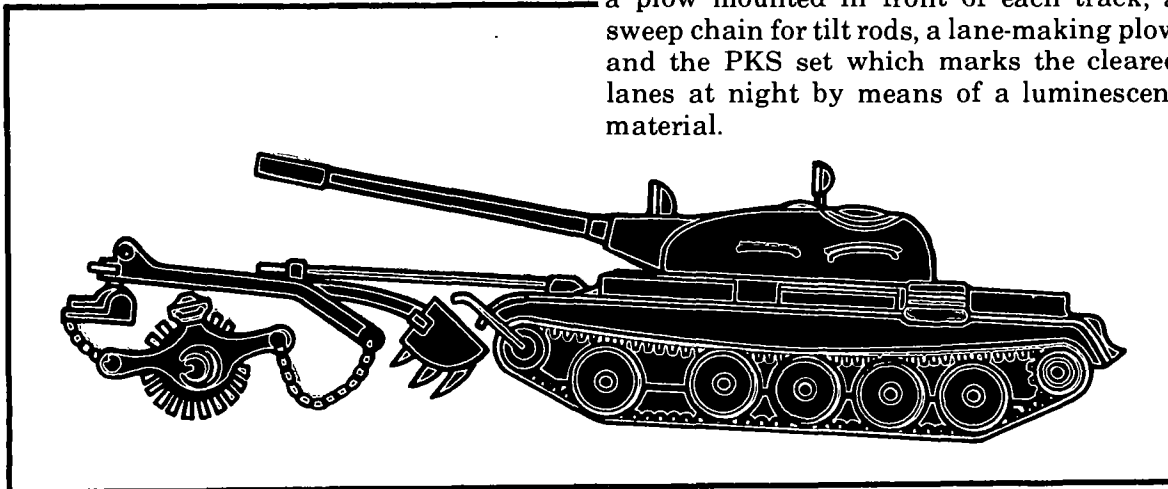


TANK MOUNTED MINE CLEARING ROLLER AND ROLLER-PLOW

The PT-55 is the standard roller in use today. It consists of four rollers mounted in front of each tank track, a sweep chain to defeat tilt rod fuzes, and a lane marker which cuts a furrow 80mm deep and 100mm wide, marking the cleared lane.



The KMT-5 system is a combination of a roller and a plow. It includes three rollers and a plow mounted in front of each track, a sweep chain for tilt rods, a lane-making plow and the PKS set which marks the cleared lanes at night by means of a luminescent material.



Characteristics:	PT-55	KMT-5
Weight	6,700 kg	7,300-7,500 kg
Roller Section Weight	unk	2,265 kg
Plow Section Weight	unk	420 kg
Assembly Width	unk	4.0 m
Assembly Length	unk	3.18 m
Lane Swept (each)	.83	.730-.810
Width Unswept	1.7 m	2.1 m
Operating Speed	8-12 km/h	unk
Safe Turning Radius	85 m	65 m
Ditch Crossing	unk	2.5 m
Attachment time	10-15 min	unk

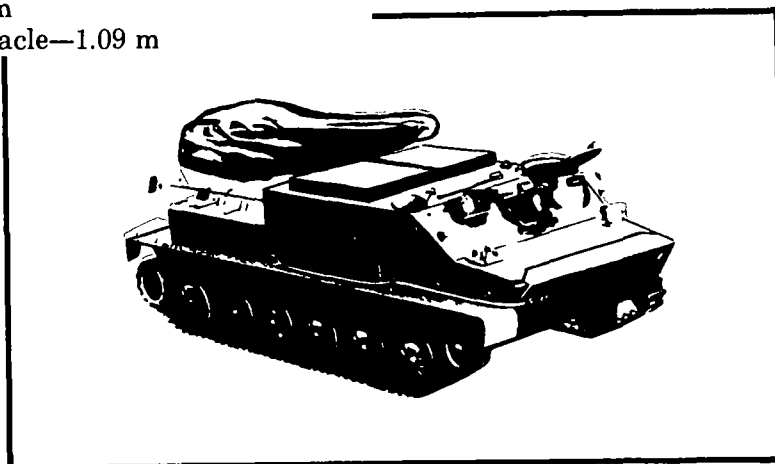
ARMORED VEHICLE LAUNCHED LINE CHARGE

The Threat forces have a special mine clearing armored vehicle in the form of a modified BTR-50PK armored personnel carrier. This vehicle has a special launcher for delivery rockets which emplaces a rather large-diameter, flexible tube containing high explosives for mine clearing.

Characteristics:

Length—6.86 m
 Width—3.15 m
 Max speed: Land—72 km/h
 Water—9.2 km/h
 Cruising range—280 km
 Slope ascending—38°
 Ditch—2.95 m
 Vertical obstacle—1.09 m

Besides the armored vehicle launched line charge, the opposing forces utilize several other types of linear charges. Bangalore torpedoes can be combined into duplex or triplex charges and are normally placed on a cart, rollers, or sled. The linear charges are constructed in a rear area and towed by a tank to the edge of the minefield. The charges are then either pushed or pulled through the field by a tank or winched by using an anchor placed or rocket delivered at the forward edge of the minefield. Line charge up to 500 meters in length can be constructed.



	Weight		Passage		Delivery Distance*		
	Running	Meters			Winch	Tank Pushed	Towed
	HE	Overall	(m)			(m)	
Single	2.65	5.10	2.5	3.0	300	----	----
Duplex	5.30	11.00	4.0	5.0	300	500	300
Duplex on cart	5.30	13.00	7.0	8.0	500	500	500
Triplex	8.00	16.00	8.0	10.0	300	500	300
Triplex on cart	8.00	18.00	10.0	12.0	500	500	500

*Delivery speeds: Winch 8 to 10 km/h, tank pushed 100m/min tank towed 200m/m.

BAT-M HEAVY ARTILLERY TRACTOR DOZER

The standard dozer of engineer units is the BAT-M. This dozer is based on a modified AT-T artillery tractor. The BAT-M has a hydraulically operated bulldozer blade and a rotary crane, which is used to lift prefabricated concrete sections for trenches and other fortifications. It is ideally suited for construction of bridge approaches, fortifications, and tank and artillery emplacement.

It is capable of heavy rough earthwork in medium soil. The blades have four settings with two side blades which are adjustable. When fully extended, the blades form a straight blade for grading or spreading earth, or may be set at an angle to form a V shaped trench. It can dig 100 to 200 m (120.8 to 260 yd) per hour. With one side extended and one angled, it can clear snow 80 cm (31.5 inches) high. This tractor can blaze a trail through brush-covered terrain at a speed of 1.5 to 8 km/h (0.9 to 5 mph), at a width of 4.1 to 4.8 meters (13.5 to 15.8 ft) and excavate pits at a rate of 120 to 400 m (157 to 520 yd) per hour.

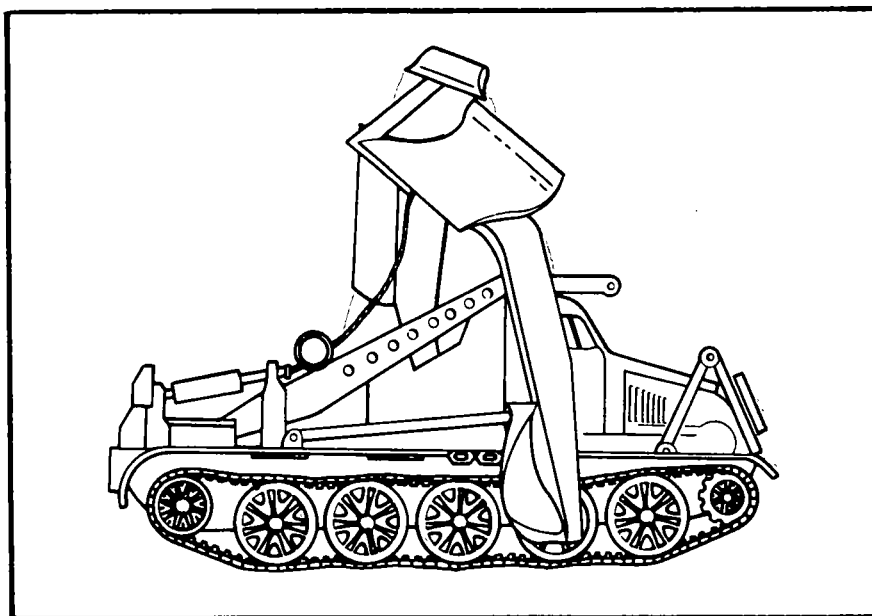
The BAT-M is replacing an older version called the BAT. The BAT does not have the crane but otherwise is identical.

Characteristics:

Weight w/blade—26 tons (28.7 short tons)
 Length w/blade—10 m (32.8 ft)
 Width w/blade—4.79 m (15.7 ft)
 Height (travel position)—3.5 m (11.5 ft)
 Track (center to center)—2.64 m (8.7 ft)
 Clearance (tractor hull)—425mm (16.7 in)
 Track width—508mm (20 in)
 Engine (water cooled)—415 hp V-12 cyl Diesel V-401
 Speed—35 km/h (22 mph)
 Working speed (max)—10 km/h (6.2 mph)
 Working capacity—120 to 400 m³/h (157 to 520 yds/hr)
 Crane capacity—2 t (2.2 short tons)
 Cruising range—400 km (250 miles)
 Ground pressure—0.68 kg/cm² (9.67 psi)
 Trench—1.58 m (5.2 ft)
 Step—1 m (39.4 in)
 Slope—30°
 Ford—0.75 m (29.5 in)
 Crew—2

Two driving lights and one spotlight on front.

Where located: In the engineer battalion of motorized rifle and tank divisions. The technical company of the engineer battalion and the pontoon company.



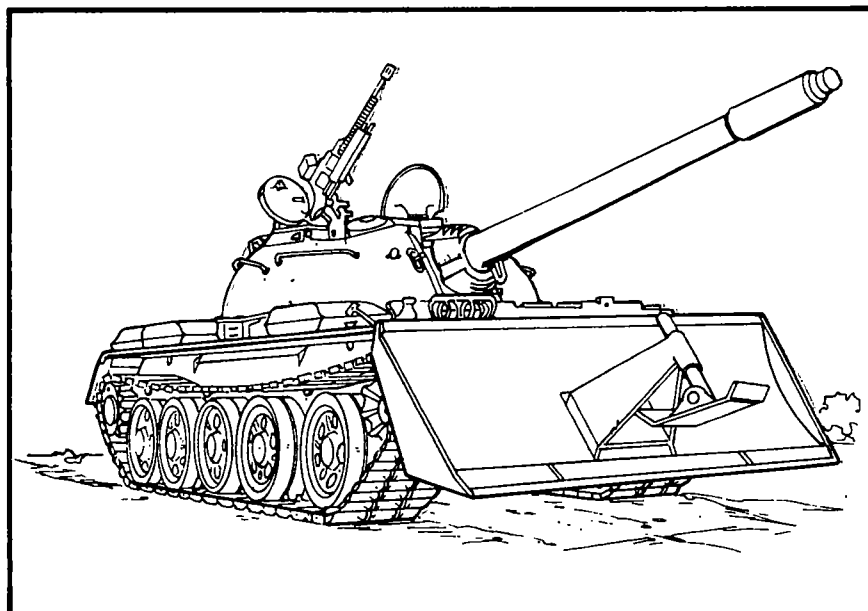
TANK DOZER BTU

A certain percentage of T-34 (85), T-54 and T-55 medium tanks have been equipped with the BTU tank dozer equipment for use within tank units requiring specialized engineer support. The tank dozers accompany the armored vehicles and are used to neutralize obstacles while under fire. The BTU dozer blades can be mounted in 90 minutes and dismounted in 60 minutes.

Characteristics: (T-54 Tank):

Weight w/dozer—38.3 tons (42.2 short tons)
 Length w/dozer blade—7.5 m (24.7 ft) (travel position)
 Width w/dozer blade—3.4 m (11.2 ft)
 Height w/o AA MG—2.4 m (7.9 ft)
 Speed—40 km/h (25 mph)
 Working speed—1.5 km/h (0.9 mph)
 Working capacity—100 to 300 m/hr (131 to 262 yds hr)
 Cruising range—250 km (155 miles)
 Ground pressure—0.85 kg/cm² (12.1 psi)
 Trench—1.6 m (5.25 ft)
 Step—0.48 m (18.9 in)
 Slope—30°
 Ford (w/o snorkel)—1.4 m (55.1 in)
 Crew—4

Where assigned: To tank battalions in MR and tank divisions.



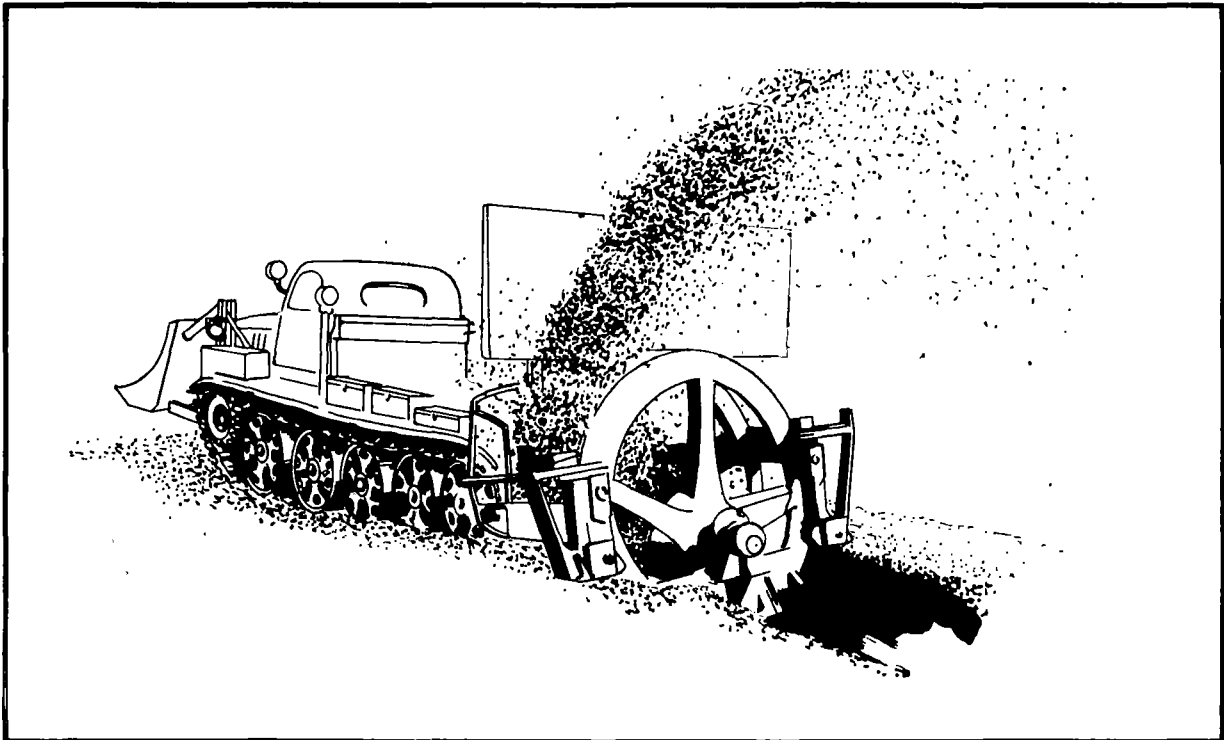
DITCHING MACHINES

MDK-2 Ditching Machine

The MDK-2 ditching machine consists of a heavy tracked artillery tractor, AT-T chassis, with a trenching component mounted on the rear and a bulldozer blade installed on the front. The trenching component consists of a rotary cutting head that rotates in a nearly vertical plane and at right angles to the longitudinal axis of the AT-T tractor. The rotary head contains eight cutting blades that remove earth and deliver it to a drum-type chute for discharge. This machine may make repeated passes through the trench to a maximum depth of approximately 4.420 m. Actual depth depends on the stability of the soil and the discharge capacity of the chute. When the desired depth is reached, the bottom and ramps of the trench are leveled with the bulldozer blade. Productive capacity is 298 cubic meters per hour. The bulldozer blade is raised and lowered hydraulically. On current models, the trenching component is also raised and lowered hydraulically, and the model designation is MDK-2M. The trenching component receives its power from the engine of the AT-T tractor.

Characteristics:

Weight—27,010 kg
 Length: in transport position—7.99 m
 in operating position—10.24 m
 Width—3.99 m
 Height: in transport position—3.93
 in operating position—3.90 m
 Ground clearance—.41 m
 Ground pressure—0.71 kg/cm² (10.1 psi)
 Travel speed—35 km/h
 Cruising range—400 km (250 miles)
 Trench—2.1 m (6.9 ft)
 Step—1 m (39.4 in)
 Slope—20°
 Ford—0.75 m (29.5 in)
 Crew—2
 Work capacity: CI II & III soil—
 300 m³/hr (392 yds/hr)
 Diameter of rotary cutting head—2.99 m
 (approx)
 Digging depth—1.49 m
 Depth of trench (max)—4.5 m (14.8
 ft)
 Digging width
 Top—3.99 m
 Bottom—3.51 m



The BTM consists of an ETR-409 ditching machine mounted on the chassis of the AT-T heavy tracked artillery tractor. It is a 10-bucket, wheel-type machine that can dig trenches with either vertical or sloping walls. Outstanding features are the tapered hood and truck-type cab, the large support post located on each side of the excavator, the prominent bar that extends across the front of the excavator wheel, the excavator that is higher than the cab in the travel position, and the large cable drum in the rear of the cab on the deck plate.

An improved model, the BTM-TMC, is capable of cutting trenches in frozen soil, although they are only 0.6 m (1.87 ft) in width. The working rate in frozen soil is 100 m/hr (328 ft/hr). The BTM-TMG has the same basic overall dimension in the travel position except that the overall length is 7.6 m (24.9 ft). It is also heavier, weighing 30 metric tons (33.1 short tons).

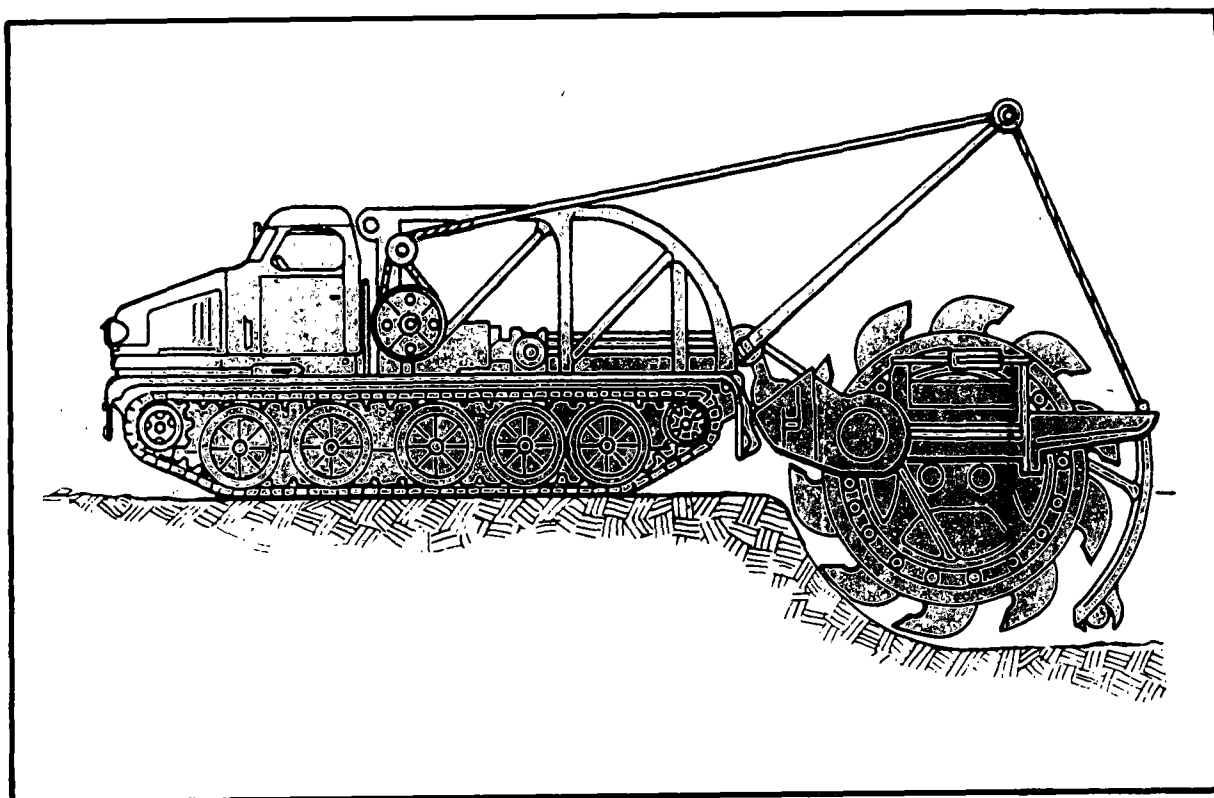
Characteristics:

Weight—26,490 kg
Length: in transport position—7,220 m
in operating position—10.820 m

Width—3,200 m
Weight: in transport position—4,300 kg
in operating position—3,510 kg
Ground clearance—.420 f
Ground pressure—.7 kg/cm²
Travel speed—35 km/h
Cruising range—400 km (250 miles)
Trench crossing capability—2.1 m (6.9 ft)
Vertical obstacle climbing capability—1 m (39.4 in)
Slope—20°
Fording capability—0.75 m (29.5 in)
Crew—2
Capacity in average soil—1120 m/hr

Capacity in average soil—1,120 m/hr
(1,225 yds/hr) with a 0.8 m (2.6 ft) deep trench
Digging depth (max)—1.490 m
Digging depth
Top—1.010 m
Bottom—1.010 m

Where located: The technical company of the engineer battalion of MR or tank divisions has either the MDK-2 or the BTM.



D-144 MOUNTED ROAD GRADER

This road grader is the most successful and most extensively used motorized grader produced by the Threat. Although equipped with mechanical controls, this is one of the few graders with leaning front wheels.

Characteristics:

Weight: Grader—13,400 kg

Scarifier—300 kg

Length: Overall—8.200 m

Width: Front—2.470 m

Peak—2.470

Peak—2.470 m

Weight: Overall—2,770 kg

Ground clearance—0.370 m

Moldboard

Length—3.690 m

Revolving cir—360°

Lift above ground—0.400 m

Depth of cut—0.210 m

Side shift—0.670 m

Pitch position—45° to 90°

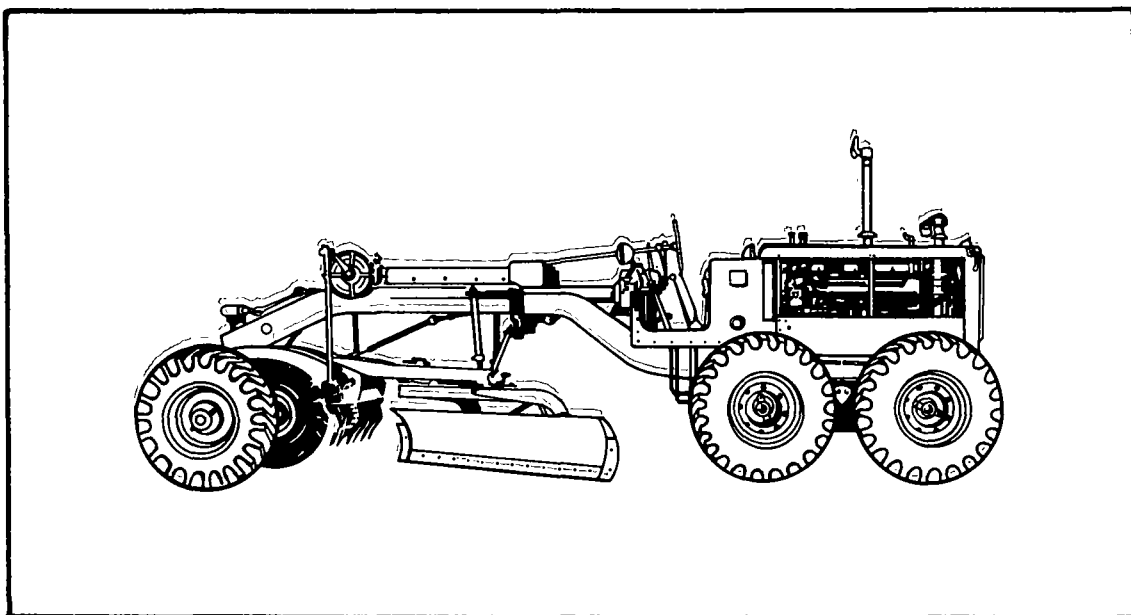
Max slope cut—75°

Scarifier

No. of teeth—11

Depth of cut—0.210

Where assigned: The D-144 is found in the technical company of the engineer battalion of MR and tank divisions.



URAL-375D 4 1/2 TON CARGO TRUCK

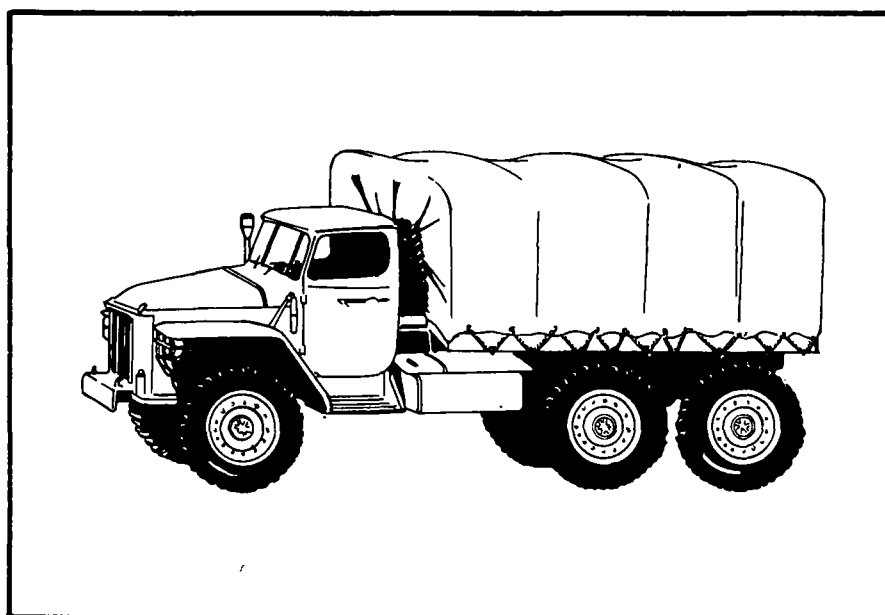
The URAL-375D is an all-wheel, gasoline powered truck rated at 4 1/2 tons payload capacity. The truck is one of the most widely used tactical trucks in the Threat army. In addition to functioning as a general cargo carrier, it is rapidly replacing the artillery tractor, AT-L as the prime mover for light artillery.

A canvas-top cab, fold-down windshield, and a stake body make it possible to reduce the truck's height for air transport. The vehicle also has power steering, a two-speed transfer case, a two-speed limited slip differential, telescopic shock absorbers, and tire air pressure which can be controlled from the driver's seat while the vehicle is in motion. A winch mounted on the rear of the frame is driven from a power takeoff. The stake body consists of a sheet metal platform with hinged tailgate at rear.

Characteristics:

Length overall—7.350 m
Width overall—2.640 m
Height overall—2.980 m
Cargo space
Length—3.900 m
Width—2.430 m
Height of sides—0.872 m
Weight:
Curb—8,400 kg
Payload off hwy—4,500 kg
Personnel load—3 in cab, 24 in rear
Max towed load—(off hwy)—10,000 kg
Max speed—(loaded road)—75 km/hr
Cruising range—(loaded road)—750 km
Max gradient loaded—65%
Turning radius—10.800 m
Fording depth—1.490 m
Winch type—mechanical
Capacity—7,000 kg
Cable length—65 m

Where located: This truck is found in engineer companies of MR and tank regiments and all companies of the engineer battalion except the amphibious company of MR and tank divisions.





5



Appendix D
EMPLOYMENT
OF THE ENGINEER
AS INFANTRY

Contents

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TROOP LEADING PROCEDURES	D-5

FACTORS FOR EMPLOYMENT

The situation that exists on the modern battlefield has led to defensive doctrine characterized by large unit sectors of responsibility and minimum reserve forces. The active defense is based upon the precept that adequate forces and weapons must be concentrated at the critical times and places on the battlefield. In this environment engineers must be prepared to rapidly execute the mission to fight as infantry. This appendix is to be used in conjunction with FM 7-8, The Light Infantry Platoon and Squad; FM 7-10, The Rifle Company, Platoons and Squads; and FM 7-20, The Infantry Battalions.

The division commander will commit engineers only after careful consideration of the following factors:

- The seriousness of the situation — will the commitment of the engineers as infantry change the outcome of the battle?
- The loss of engineer effort — how can the engineers provide the greatest contribution for the success of the battle?
- Strength of the engineer unit — does the engineer unit have enough personnel to be effectively employed?
- Support to the engineer unit — will the mission be of an offensive or defensive nature, and what fire and logistical support can the engineer unit expect to receive from adjacent and higher units in carrying out its mission?
- Self defense is required.
- The unit commander is forced into a combat role in order to save the unit.
- Directed by the division CG.

The engineer and his immediate tactical commander in the formal reorganization process must give consideration to the following:

- Since division engineer units normally are spread throughout the division area and will probably have little warning, they are more likely to be employed as individual companies rather than as a battalion. Corps units, on the other hand, because of the time and distance involved, are more likely to be employed as battalions when operating in the division forward area.
- An engineer unit has certain equipment and training shortcomings that do not allow it to be compared one for one with an infantry unit of the same size. It is deficient in antitank weapons and artillery liaison personnel.
- The organization of an engineer unit for an infantry mission requires reaction time. A trains area and rear area for special purpose equipment must be established, necessary weapons and communications equipment drawn, specialized personnel attached, and new command and support channels established.
- The mobility of the engineer unit must be considered. Armored and mechanized divisional engineer battalions are equipped with APCs. Those of the corps and the other divisional types are equipped with dump trucks.
- The decision to employ an engineer unit as infantry is usually made only in very critical circumstances. When an engineer unit is employed as infantry, **ENGINEER ABILITY TO PERFORM ENGINEER MISSIONS FOR THE FORCE AS A WHOLE IS EXTREMELY LIMITED**. This loss of engineering ability may be temporary, lasting only as long as the infantry mission

CONDITIONS FOR FIGHTING AS INFANTRY

The engineer battalion or any element thereof, fights as infantry when—

- The enemy prevents access to the unit's job site.
- The enemy attempts to drive the engineer unit from a job site.
- The enemy prevents delivery of supplies.

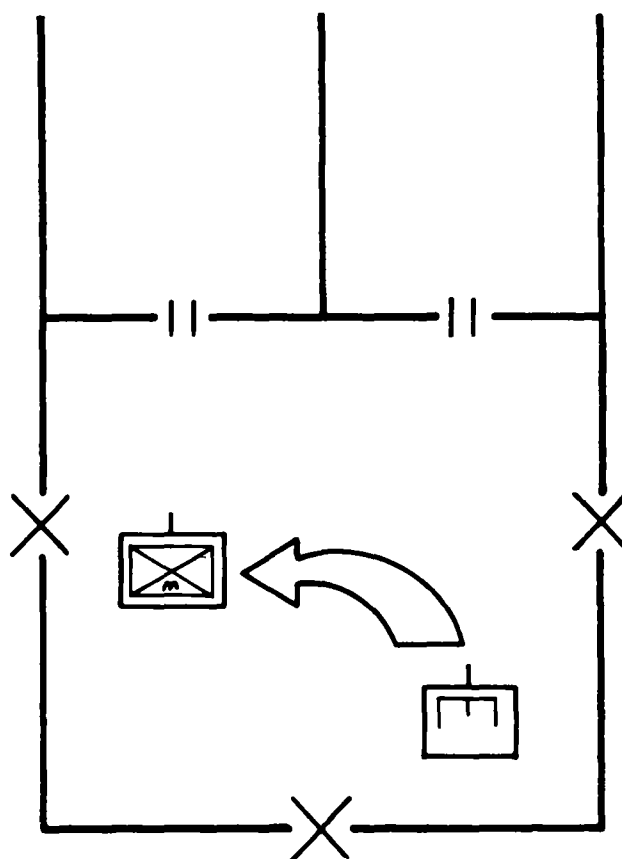
lasts. However, if carrying out the assigned infantry mission results in heavy losses to the engineer unit, it may suffer a long term reduction in its support capability that must be considered in planning future operations. The commander must first determine that the need for fighting strength is more important to the success of his overall mission than the corresponding loss of engineer support.

Typical situations in which engineers may be employed as infantry include:

- An economy of force measure.
- A sudden enemy penetration. (Engineer unit is organized to block and use its Dragons as the tank-killer team in an enemy armored penetration.)
- An enemy air assault operation.

REORGANIZATION

The emergencies which necessitate the organization of engineers to fight as infantry may preclude the removal of engineer equipment from the battle area. Equipment parks should, however, be designated and equipment withdrawn when not needed. When this is not possible, equipment unable to maintain the required mobility may be handed off to other engineer units or destroyed in place to prevent its use by the advancing enemy. The CEV and AVL B will have a direct impact upon the battle and should be retained and used by the engineer unit as long as possible.



REDUCTION OF AN ENEMY AIR ASSAULT

When time permits, engineer equipment is evacuated from the battle area. This results in the deployment of engineers in three echelons:

- 1 - FORWARD ECHELON**
- 2 - TRAINS ECHELON**
- 3 - REAR ECHELON**

Echelon	Composed of	Command and Control Exercised by	Location
• Forward	Fighting elements	Bn Cdr Co Cdr	MBA
• Trains	Maintenance Mess Supply Administration	S4 S1	5-10 km to rear of fighting forces
• Rear	Special Purpose Equipment	Engineer Equipment Officer	10-20 km to rear of fighting forces

COMMAND AND CONTROL

The division engineer battalion commander will continue to be responsible for all engineer effort even when some or all the engineers are committed as infantry. If the division engineer battalion is committed as infantry, the full load of this responsibility

will fall on the ADE. The corps engineers will continue to receive direction and mission assignments from the ADE. The corps engineer units will establish liaison with the ADE for all engineer missions.

The following chart lists the engineer responsible for directing engineer effort when engineers are committed as infantry.

Case	Engineer Battalions in Division Area	Engineers Committed as Infantry	Directs and Coordinates Engineer Work in Division Area
Case 1	Divisional Corps	Corp Engineer Battalion	Division Engineer
Case 2	Divisional Corps	Division Engineer Battalion	ADE*
Case 3	Division Corps Engineer Group	Corp Engineer Battalion	Division Engineer
Case 4	Division	Division Engineer Battalion	ADE

*When the division engineer battalion is employed as infantry the ADE remains at the division TOC to continue engineer staff planning.

THE SOP

The most effective way to fully utilize whatever reaction time an engineer unit might have prior to assuming an infantry mission, is to follow a well-prepared SOP. An awareness of the fluid nature of today's changing tactical environment points out the need to constantly verify, update, and revise the SOP. We know that engineers organized as infantry have requirements which can only be filled from outside sources. Some of these requirements are: artillery mortar support and medical support, additional crew served weapons, additional communications equipment, and associated specialized personnel. We need to address each of these requirements within the current support organization structure and either find a solution or insure that the tactical commander is advised of the limitations of engineers organized as infantry. As soon as the engineer unit is moved and attached or placed in direct support of another element, requirements must be reviewed and new arrangements concluded. Once support sources have been identified, internal

responsibility assigned, and tasks assigned priorities, we can develop an SOP that helps insure that we can assume an infantry mission within a minimum reaction time.

The SOP should cover many important areas. Some of those requiring careful consideration and detailed planning are:

- Subordinate units must be informed that configuration as infantry has been directed. The use of a signal or code word to implement desired actions may be an efficient method of initiating the mission to organize as infantry.
- Duties of each staff element within the battalion must be clear and actions required must be specified. Location of the staff element in the forward or rear echelon must be stated.
- Composition of battalion rear and forward echelons must be detailed. Evacuation of engineer equipment must be addressed as a portion of the rear area. The battalion rear command and control must be defined.

The engineer battalion, when configured to fight as infantry, has a relative deficiency in firepower when compared to its infantry counterpart. For this reason, the SOP must describe source and allocation of additional weapons and related matters indicated below:

- The engineer battalion may require additional communications equipment. The source and allocation of this equipment must be defined.

- Organization of the battalion TOC should be described.

- Fire support must be clarified. This should include the addition of an artillery forward observer.

- Medical support organic to the engineer battalions may not be sufficient when

committed as infantry. Medical evacuation channels also need to be identified.

- Control and support channels.

- Responsibilities for rear area security.

- Special reporting.

- Logistics — supply and resupply.

- Organization of forward and rear echelons.

- Each unit has individual operating characteristics which must be considered in any plan for reorganization.

The SOP, no matter how complete, is no substitute for aggressive unit training for the infantry mission. The following table displays actions which must be taken quickly when the unit is organized as infantry.

Actions at the Battalion	Actions at the Company
Implement SOP Inform subordinate units Designate engineer equipment parks Coordinate with supported unit for: • Artillery support and forward observers • Medical support to include personnel, equipment, and evacuation channels • Communications procedures and nets • Additional weapons • Sources of logistical support • Withdrawal of engineer support	Implement SOP Designate engineer equipment parks Designate assembly area for the company Inform higher headquarters of current fighting strength and critical TOE shortages Coordinate for withdrawal of engineer support Redistribute ammo and weapons Prepare to move on orders

TROOP-LEADING PROCEDURES

Troop-leading procedures are the process by which a commander issues instructions to his subordinates so he can accomplish his mission. The lower the echelon, the more simple, direct, and rapid is this process. Once the battle starts, subsequent orders and responses must be fast, effective, and simple; this requires teamwork.

Troop-leading steps should be an instinctive and automatic way of thinking for platoon, company, and battalion

commanders. Without detailed instructions commanders must turn a mission order into action supporting the plan of the next higher commander. Elaborate troop-leading procedures are useless if they slow down the response of the force. SOPs must be designed to simplify these procedures.

Troop-leading steps and their order are not rigid; change them to fit the mission and situation. Often some steps are taken at the same time, while others are continuously

considered throughout the operation. When there is not enough time, certain steps may be left out.

The eight steps of troop leading are:

- 1 **Receive the mission.**
- 2 **Issue a warning order.**
- 3 **Make a tentative plan (that will accomplish the mission).**
- 4 **Start necessary movement.**
- 5 **Reconnoiter.**
- 6 **Complete the plan.**
- 7 **Issue orders.**
- 8 **Supervise (and refine the plan).**

1 Receive the Mission

Leaders receive a mission in either an oral or written operations order (OPORD) or a fragmentary order (FRAGO). Upon receiving an order, the leader analyzes his mission and plans the use of available time.

2 Issue a Warning Order

The leader issues a warning order, telling his subordinates the mission and the time it starts. He issues it early enough so the team has time to plan and prepare. Normally, warning orders are issued through the chain of command; in that way, all personnel are kept informed of what they must do and why.

3 Make a Tentative Plan

Company commanders are responsible for tentative plans based on explicit orders from the battalion commander, such as:

4 Start Necessary Movement

The company commander must now make good use of the available time so that his platoon leaders can reconnoiter, move, prepare, and fit their units and weapons to the ground. If the company must move a considerable distance, it should be set in

motion immediately based on the first rough plans. This lets the platoons and squads, as well as the commander, get on the ground early.

Brief oral orders must be met with instant movement by every team element. When the team commander is called to receive an order, he brings with him someone of authority to go back to the company, prepare it, move it, and make arrangements to meet the platoon leaders *on the ground* to issue his order. The company executive officer (XO) can assemble the platoon leaders and brief them. The first sergeant can move the company. This frees the commander to make his reconnaissance, check his plan, and be ready to issue his final order. The commander must have a standard system for this purpose and practice it until it works smoothly under sudden changes (e.g., FRAGOs, orders on the move).

5 Reconnoiter

Upon completion of his reconnaissance, the commander decides how to place his company and its weapons. Map reconnaissance cannot substitute for ground reconnaissance.

6 Complete the Plan

Reconnaissance may or may not change the plan, but it certainly will add detail. Keep the plan fitted to reconnaissance information.

7 Issue Orders

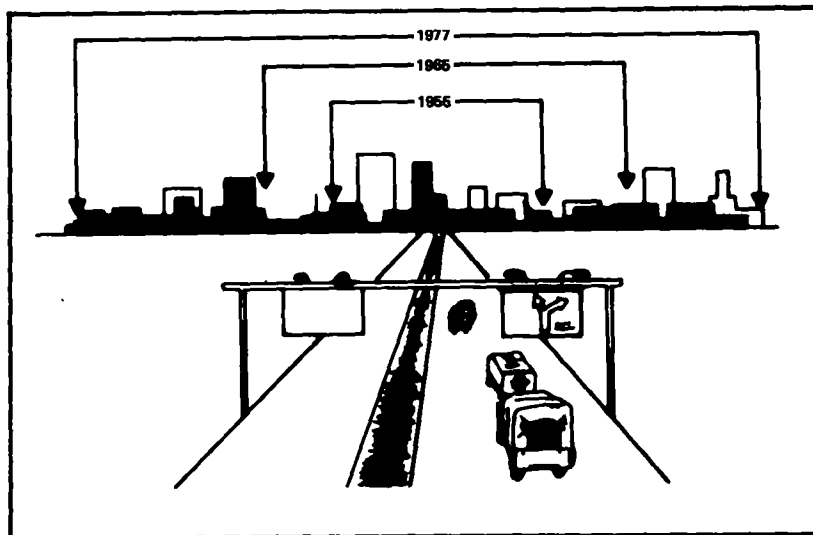
Company commanders issue orders orally; they may also issue marked maps, checkpoints, concentrations, or other devices to help control. But, since its operations depend on the terrain, the company needs a continuous flow of explicit instructions. Written orders are not suitable at company level. **Nothing should slow down the flow of explicit orders.**

8 Supervise

A leader must continuously supervise the preparation for, and execution of, the mission. **Constant supervision is as important as issuing the order.**

Appendix E

MILITARY OPERATIONS IN URBANIZED TERRAIN (MOUT)



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URBANIZATION – THE TACTICAL IMPACT. The ever-increasing urbanization of the world dictates that today's commander be fully prepared to conduct *military operations in urbanized terrain (MOUT)*. The fact that the large urban complexes of Western Europe extend over the traditional avenues of approach for vehicular movement forces commanders to be MOUT conscious.

CHARACTERISTICS OF URBAN COMBAT

Categories of Built-Up Areas

- (1) Villages (population of 1,000 or less).
- (2) Strip areas (generally interconnecting built-up areas between villages and towns along roads and valleys).
- (3) Towns and small cities (population up to 100,000 and not a part of a major urban complex).
- (4) Large cities with associated urban sprawl (population up to millions covering 100 or more square miles).

The CATEGORY of a built-up area relates to the COMMAND LEVEL of operation required.

<u>Categories</u>	<u>Normal Operational Command Level</u>
(1) & (2)	Company/Battalion
(3)	Brigade/Division
(4)	Division/Corps

For the defender, MOUT has—

Advantages

- Protection against all types of fires; readymade strongpoints.
- Prepared obstacles.
- Good cover and concealment.
- Fire lanes and kill zones.

Some disadvantages,

- Fixed defense.
- Vulnerability to CBR attack.
- Lack of visibility and shorter range target acquisition.

VILLAGES



The typical village, especially in Europe, has stone, brick, or concrete buildings (stores, houses, and barns) in a cluster, with a number of more modern and more lightly constructed houses on the outskirts.

Defense

- Villages are often spaced 2,000 to 4,000 meters apart. Tanks and ATGMs may be able to cover the open ground between villages and provide mutual support to other villages. Battle positions within a group of adjacent villages can provide a system of prefabricated and mutually supporting positions.

- Villages may be battle positions from which to attack the enemy and then move to new positions before the enemy mounts a deliberate combined arms attack to close on the position.

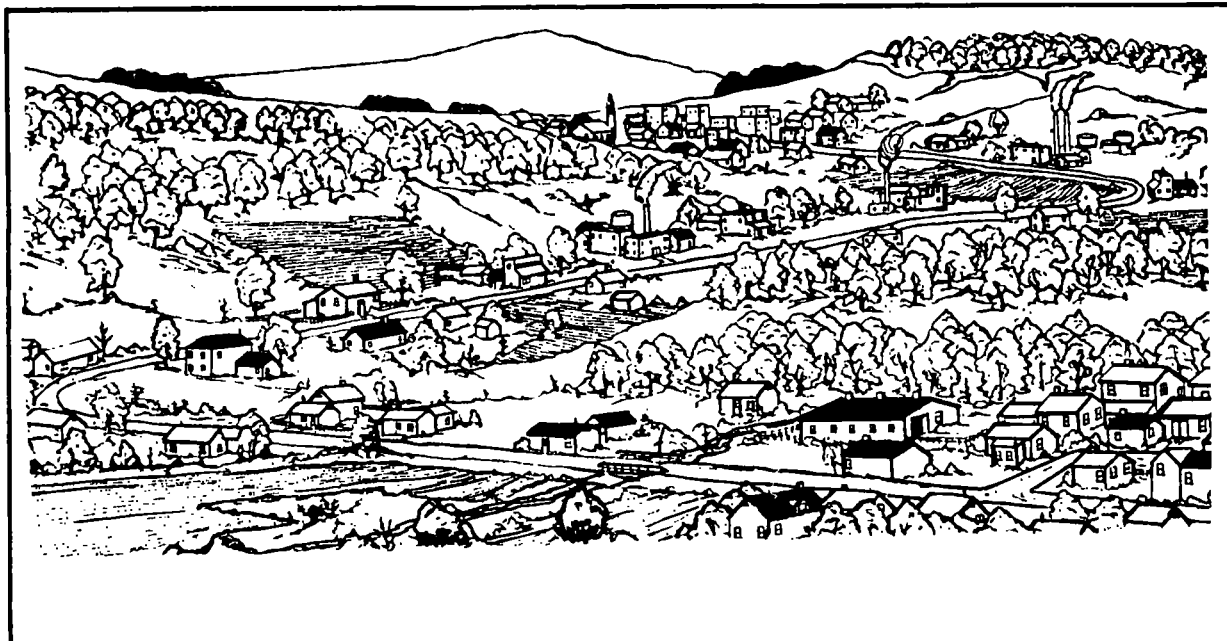
- Villages are also used as natural strongpoints as described in appendix I.

Offense

- Defended village strongpoints should not be attacked if they can be suppressed or bypassed. It may be necessary to eliminate resistance from a defended village which blocks a supply route or is inflicting losses on bypassing forces.

- Mechanized infantry accompanied by tanks and *combat engineer vehicles*, should move to the cover of outlying buildings and then seize the village in its entirety in one assault. *Combat engineer vehicles* can employ the demolition gun to destroy strong buildings that slow the assault.

STRIP AREAS



Where houses, stores, and factories have grown up along roads or down valleys between towns and villages, strips can present an approximation of a fortified line.

Defense

- Defender may not be able to occupy the entire strip and associated villages and towns.
- Defender can occupy positions within the strip and deceive the enemy into thinking it is an extensive defensive line.
- Tanks and ATGMs can inflict high losses on attacking enemy armor and slow his momentum.
- Strips afford covered avenues of withdrawal to the flanks.

Offense

- Strips are not easily bypassed and therefore weak points should be isolated through suppression and obscurity.
- Heavy concentration of direct and indirect fire should support a penetration through the strip by a fast-moving armor force.
- If the enemy force does not withdraw after the penetration, suppression and obscurity of the flanks must continue for the force to pass through.
- Areas must be reduced by follow-on forces.

TOWNS AND SMALL CITIES



Towns or cities have a definable limit. The decision to attack or defend a town or city must be made by corps or division commanders because of the forces required and the time consumed.

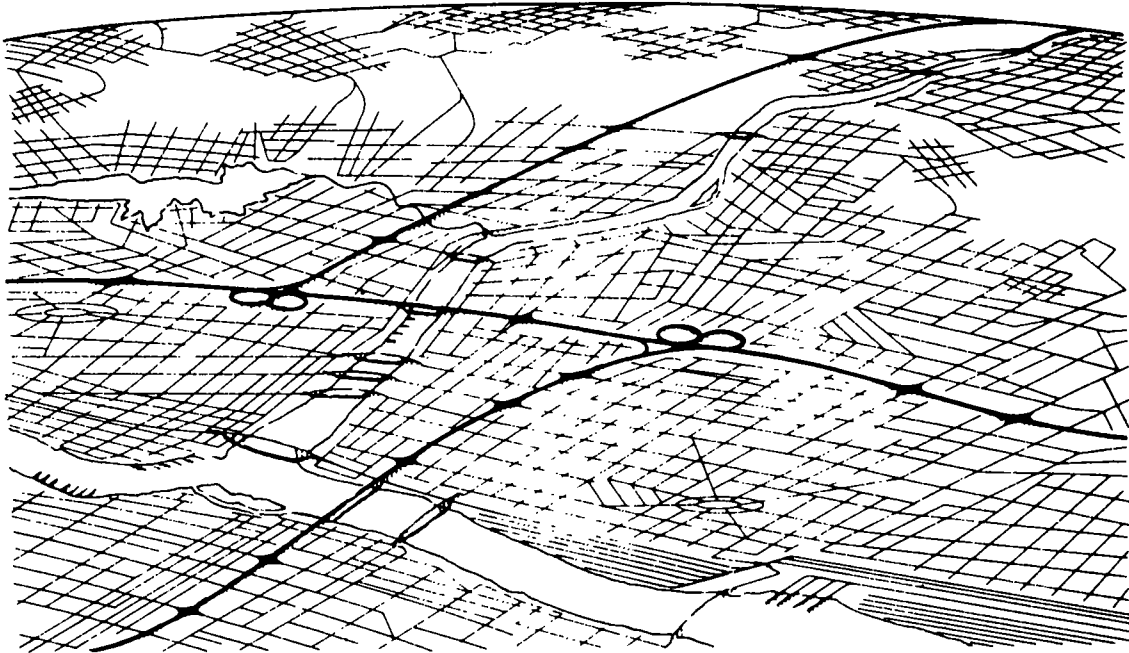
Defense

- Critical approaches must be selected and tanks and ATGMs sited to gain maximum attrition of the attackers. Obstacles and minefields assist in slowing and canalizing the attack.
- Landing and drop zones, such as parks or stadiums, should be covered with obstacles or fire.

Offense

- Assault units are task organized with tanks, infantry, and combat engineers for the breakthrough.
- Overwatching point target destruction fires, obscuration, and indirect suppression help to gain an entry into the town.
- The assault units must suppress enemy AT weapons in order to maintain their mobility.
- Direct and indirect fires are used for suppression and destruction. Soon, fuel air explosives will be available for this purpose.

LARGE CITIES/MAJOR URBAN COMPLEXES



Major urban complexes such as Frankfurt/Mainz/Hanau or the Stuttgart area are so large that they cannot be captured or defended in their entirety, and they cannot be avoided by bypassing. The commander has no choice but to conduct the whole range of military operations within them — attack, defense and retrograde. These areas have the characteristics of a concrete jungle, visibility is reduced and cover and concealment abound.

Defense

- Key transportation centers that offer the enemy rapid lateral or forward movement will be denied by fire, obstacles, and/or occupation.
- Strongpoints must be established to block major communications corridors.
- Subways, sewers, storm drain systems, and other underground passageways must be blocked to prevent unobserved access into the inner city.
- Accurate intelligence and special map products greatly assist the defense.
- Routes to friendly positions must be kept open for troop movements and resupply.

Offense

- The attacker is most vulnerable to enemy fires during the initial attack to secure a foothold in the city.
- Extensive use of smoke will be required to conceal the initial assault and subsequent fire and maneuver operations.
- Combat engineers are required to breach obstacles, clear paths through rubble, and support destruction of strongpoints and fortified positions.

ENEMY DOCTRINE

Defensive Operations in Built-Up Areas

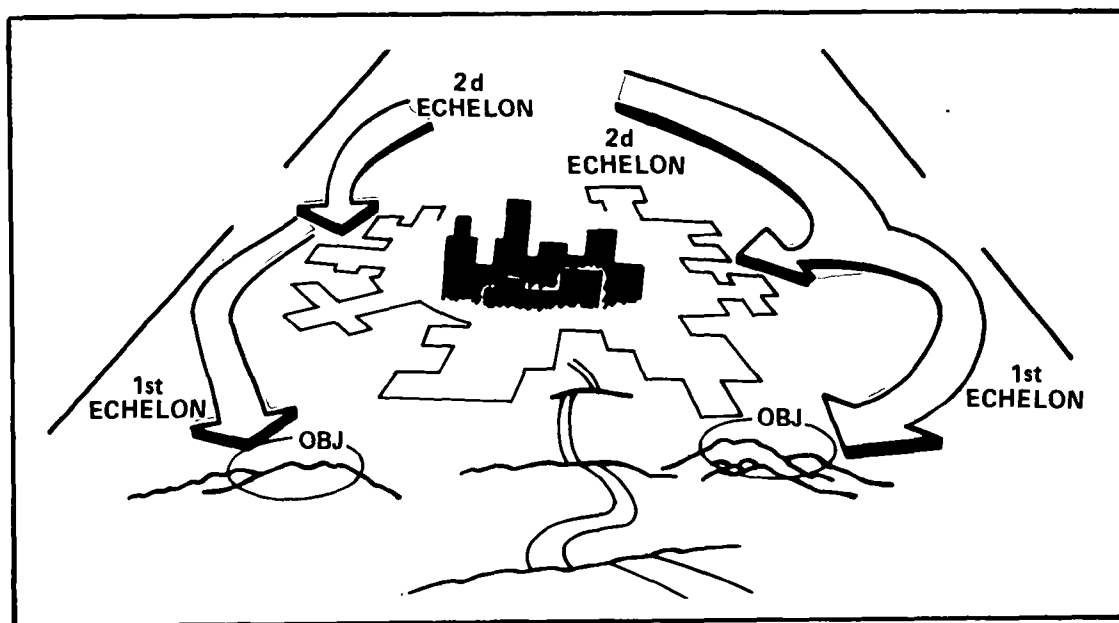
Offensive Operations Against Built-Up Areas

Primary enemy *doctrine* for offensive operations against built-up areas is to *avoid them* when possible, and to attack and seize them *from the march* when necessary, by armor-heavy forces. Reconnaissance elements attempt to enter and move rapidly through the built-up area before defenses can be established. If this attack is halted, the *leading units* are directed to *bypass* rather than risk loss of momentum.

The *second echelon* will be given missions of penetration, security, or clearance and reduction, depending on the situation and the mission-success of the first echelon.

The second echelon is *not* a reserve force to be employed should the first echelon falter; its added weight *must* be expected by the defender commander.

Enemy doctrine regarding the defense of built-up areas has been to avoid them whenever possible. If forced to defend from a built-up area, the enemy will base his defense on the motorized rifle battalion. His actual defense of the built-up area is closely tied to strong positions on the flanks of the built-up area. The enemy plans to hold strongpoints within the built-up area at all costs. This is to be expected, particularly if he is defending his homeland. He will defend these strongpoints even to the point of accepting isolation and fighting beyond hope of reinforcement, resupply, or relief. Should a critical strongpoint fall, he executes counterattacks in force immediately to regain the lost strongpoint.



COMBINED ARMS CONSIDERATIONS

General

Military operations in built-up areas require the combined arms teams. While it is primarily an infantry struggle, the heavier firepower of the tank, field artillery, obstacle reduction of CEV, demolitions, and close air support are fundamental requirements. The following paragraphs present significant characteristics of team members as they function in MOUT:

Tanks

Tanks are used in the covering force and along the FEBA/periphery where their long-range fires can be most effective.

Within the built-up area, tanks will be used to attack/support strongpoints and obstacles.

Infantry

Infantry supports tanks by locating targets, suppressing anti-aircraft systems with automatic weapons, and providing local security during periods of reduced visibility.

Field Artillery

Field artillery fires may be counter-productive, as the rubble resulting from heavy artillery fires increases the obstacle nature and value of the built-up area.

The close proximity of troops to the enemy may require a temporary friendly withdrawal during a fire mission.

Target acquisition will be difficult and will require increased emphasis.

Fire planning must include the mortar for close-in, indirect fire support. Mask clearance will tend to restrict howitzer support from division artillery.

On withdrawal of the covering force, the artillery allocated to it will displace to positions to the rear. *On withdrawal of the covering force*, the artillery allocated to it will displace to positions to the rear and outside of the built-up area, from which it can attack enemy reserves and lines of communication.

Army Aviation.

The degree of use of Army aviation is dependent on the enemy air situation, air defense, terrain within and adjacent to the built-up area, and the availability of suppression means.

Missions for Army aviation include:

- Employment of aerial weapons on approaches to the built-up area.
- Rapid movement of forces to reinforce or exploit within the built-up area.
- Combat service support, command and control, communications relay.

Close Air Support

Heavy bombardment is often counter-productive, especially in the attack of a built-up area, because of the rubble effect. Proximity of forces requires precision-guided munitions and/or the temporary withdrawal of friendly forces in contact. Political restrictions and the effects of weather will always be a factor in planning the use of close air support.

CONTROL MEASURES AND COMMUNICATIONS

Control measures are ready-made; streets, blocks, buildings, and intersections offer ready-to-use, easily identified unit boundaries, lines of departure, and directions of attack. For example, a spray can of paint used on a building can indicate its status (friend/foe), direction of attack, or any other brevity code/prearranged message desired.

Communications in a built-up area require careful planning and continuous management. The use of FM radio is restricted by terrain screening and interference and must be supplemented by wire, messenger, and prearranged signals. The slower pace of the battle and the concentration of forces are parameters that may allow and/or force greater reliance on the messenger, either foot or cycle-mounted. Existing civil communications-electronic systems can be used to a limited extent, but they are not secure and are subject to interception and damage by both attacking and defending forces. Commanders must

plan communications to minimize interference and masking problems by properly siting relay and retransmission equipment and antennas, by laying wire between defending locations, and by using protected and concealed routes for messengers. Commanders at the fighting echelons must be prepared to fight the battle with less reliance on FM radio and more reliance on wire, visual, and other prearranged signals.

ENGINEER OPERATIONS IN BUILT-UP AREAS

General

Military operations in built-up areas or MOUT contain special considerations with respect to engineer employment doctrine. However, MOUT does not introduce any great need for basic doctrinal change. Rather, MOUT indicates a need to take existing doctrine and apply it with a different approach and in a different environment.

A built-up area compares closely with a fortified area because it presents an artificially modified environment which is easily converted to a fortified area. Instead of having to build the fortifications, they are already there in the form of buildings and canalized streets. Therefore, by using doctrine on fortified areas, the employment of engineers in MOUT can be developed in consonance with modern equipment on the modern battlefield.

A built-up area is easily converted to a fortified area. The employment of engineers in MOUT is similar to operations against strongpoints and other fortified positions.

Offense

The first consideration is mobility. Initial engineer tasks are to conduct engineer reconnaissance of the obstacle system likely to be found in front of the built-up area and to obtain as much information about facilities and defenses within the city as possible. Particular attention should be paid to determining the depth and specific disposition of major obstacles. After this information has been collected and studied, engineers should next be utilized to remove

selected obstacles along the axis of advance to the built-up area. Upon reaching the built-up area, the engineer role will change. Detailed planning by engineers is essential because missions require small sapper-like teams to assist in house, rooftop and underground fighting. These units must understand their missions and be prepared to separate into small elements upon entering the city. Their primary missions are breaching and clearing operations.

Engineer clearing parties are usually divided into the following small teams:

- Leading team to clear boobytraps and antipersonnel mines
- Team to breach obstacles
- Team to mark gaps and routes between obstacles
- Replacement team for reinforcement
- Local security team

The degree of destruction must be controlled. Demolitions and CEV main guns create rubble and this rubble can be used as an effective barrier. Commanders will have to determine the value of firepower versus the creation of rubble as they affect the attack. Every engineer must understand this consideration or he may be doing more damage than good.

Engineers in the attack must not only be prepared to accomplish a wide variety of missions. They must be prepared to accomplish them as a countersniper tactic during the hours of darkness.

Combat engineer vehicles (CEVs) are well suited for MOUT and should be used well forward in the attack to clear obstacles. The CEV with its 165mm demolition gun has an effective range of 800-1,000 meters and can be used against targets such as pill boxes, bunkers, and reinforced concrete structures. Although the CEV is a heavily armored vehicle, it is designed for use as a combat support vehicle, not as a tank. When employed in forward areas subject to enemy tank or antitank fire, it must be protected from tanks or antitank weapons. Further limitations include the same maneuverability

restrictions that are characteristic of a tank in built-up areas.

Defense

General

Engineers in defensive MOUT operations are primarily employed in countermobility operations. Obstacles must be planned in depth, starting well forward of the built-up area to slow down the enemy and channelize him. Defensive MOUT missions will probably consist of the following:

- Participate in obstacle planning.
- Prepare specific obstacles in accordance with defense plans.
- Assist friendly units in preparation and camouflage of defensive positions.
- The maneuver commander occupying a strongpoint organizes the force, sites obstacles, and designates the defensive positions. The engineer prepares the positions and obstacles with manpower assistance as necessary and available from the maneuver force.

Obstacles

Engineers are limited only by their imagination in constructing obstacles within a MOUT environment. The manipulation of rubble by the CEV will create a highly effective obstacle and roadblock. The use of demolitions to create instant barriers is readily apparent. Mine operations can deny avenues of approach to the enemy.

Conventionally Emplaced Mines.

Antipersonnel and antitank mines may be employed in a variety of ways. They can be used as part of an obstacle, tied into wire or rubble, or used to boobytrap city structures in MOUT.

Unconventional Mining.

Once the authority to employ boobytraps is granted, effectiveness is limited only by imagination or ingenuity. The use of manufactured dirty trick devices, boobytraps, and improvised mines may be preferred over conventional mines or may be used if other mines are not available.

M180 Cratering Demolition Kit

The M180 kit makes effective craters easily, quickly, and cost effectively. It does not require emplacement of charges in the ground; therefore, the ready-to-use kit can be emplaced in about 10 minutes.

MOBILITY

- Good reconnaissance is vital.

Where are obstacles?

What type?

Where are strongpoints?

- Detailed planning is a must.

How much engineer effort is required?

What is the best engineer task organization?

What engineer system can best be used?

- Engineer missions will include--

Clearing mines and boobytraps

Clearing rubble and obstacles

Demolishing buildings being used on defensive positions.

MOUT requires small unit tactics. Engineer squad-sized task forces may be attached to infantry forces. Tailor them carefully.

It is essential to plan for and make good use of engineer equipment. Combat engineer vehicles are well-suited for MOUT and are located in each division engineer company. The CEV with its 165mm demolition gun has an effective range of 800-1,000 meters and makes rubble out of masonry targets. The CEV can also be used to—

- Remove obstacles by use of the bulldozer, winch, or boom.
- Clear rubble and debris.
- Construct tanks and gun emplacements.

COUNTERMOBILITY

Obstacles will be planned in depth and in width, starting well forward of the built-up area to slow down the enemy and canalize him into the built-up area. Remember, the enemy wants to use his first echelon.

Within the built-up area, engineers are limited only by their imagination in constructing obstacles.

Use rubble, CEVs, surface launched unit fuel air explosive (SLUFAEs), and demolitions.

Demolitions in sewer lines make good craters. The M180 is surface emplaced.

Narrow streets make mining effective.

SURVIVABILITY

Survivability in built-up areas is discussed separately from offensive and defensive operations because it plays an important part in both. Even in the assault, once the attacking troops have entered the built-up area, survivability must be considered.

Engineers help provide the tactical unit with reinforced automatic weapon/ATGM positions.

Stockpiling of material at sites where buildings are to be reinforced and automatic weapon/ATGM positions are to be prepared should be a high priority task. Stockpiling insures that positions can be improved by the tactical force occupying the position should the engineers be unable to complete the positions prior to the infantry occupation. This includes placement of sand, sandbags, barbed tape/concertina, and claymore and other apers mines at the selected buildings.

Class IV material should be directed, using the throughput principle, to the emplacement location.

Engineer Checklist

- ☐ Make sketch map of town.
- ☐ Number every building.
- ☐ Look for strongest buildings and list defensive points of each one.

—*Good construction (ceilings to support weight of roofs and upper stories).*

—*Number of doors and windows.*

—*Things that catch fire.*

—*Fields of fire.*

—*Basements.*

- ☐ Stockpile material at sites where buildings are to be barricaded/reinforced and automatic weapon/ATGM positions are to be prepared.
- ☐ Identify available civilian resources.
- ☐ Prepare automatic weapons/ATGM positions.
- ☐ Locate Dragons, LAWs, and TOWs in buildings, preferably on the second floor of each and in large, well-constructed, and well-ventilated rooms.
- ☐ Plan for a Dragon in a corner room of a corner building so that it can fire to the flanks as well as straight ahead.
- ☐ Use M202 rocket launcher to fire from top floor over rubble.
- ☐ Remove glass from windows and doors and other loose material from buildings to be occupied by the tactical force.
- ☐ Cut holes in ceilings to move by rope from floor to floor.
- ☐ Remove or block stairs.
- ☐ Reinforce buildings with beams.
- ☐ Fill in building tops.
- ☐ Place chicken wire on openings to reduce vulnerability to grenades.
- ☐ Coordinate the turning off or disconnecting of gas, electricity, and other utilities with civil affairs and local government officials.

FIRING ANTITANK WEAPONS FROM BUILDINGS AND ENCLOSED AREAS

WEAPON	MIN. SIZE FRAME STRUCTURE	MIN. SIZE MASONRY	MIN. VENT SIZE*
LAW	7' x 10'	MIN OF 4' TO BACK WALL	20 Ft ²
DRAGON	15' x 15'	17' x 11'	20 Ft ²
TOW	20' x 30'	20' x 20'	20 Ft ²

All glass should be removed from windows, doors, and within rooms. Soft furniture and curtains should be left to absorb sound. Firers must wear helmets and ear plugs. Don't stand behind weapons being fired.

**Open door and window space*

GENERAL ENGINEER SUPPORT

MOUT is an engineer-heavy type of operation. Commanders must be prepared to provide additional nondivision engineer effort for units engaged in MOUT.

Use of Heavy Equipment from Corps

The heavy equipment found in combat engineer companies and battalion heavy equipment platoons should be used in the rear during MOUT to open lines of communication and maintain MSRs, and should not be used in forward clearing operations. The equipment was not designed for frontline utilization and the operators are extremely vulnerable.

The tremendous amount of rubble created in MOUT and the need for quick removal or relocation of this debris makes the use of this engineer equipment essential. An assigned team of engineer equipment can follow the main attack with dozers, scooploaders, dump trucks, and even cranes to complete this mission as quickly as possible.

Heavy equipment may be used to destroy or emplace hasty obstacles. By employing the dump truck, obstacle material may be brought to the site, offloaded, and placed into position. The front loader and dozer can be used to move rubble short distances into obstacles or to create an obstacle consisting of overturned buses, vehicles, and even railway cars.

Topographic Support

The corps cartographic company can provide cartographic drafting and reproduction support to include map overlays or overprints. The cartographic company can precisely superimpose arbitrary grid systems, approximate scales, and mass-produce separate 9" x 9" prints, or, given a 72-hour leadtime, mass-produce hard copy photomaps with grid and scales. Such photomap substitutes are valuable in the absence of city maps. Oblique, low level photographs, available from the G2, are also valuable map supplements.

Existing town plans, at scales between 1:5,000 and 1:15,000, are listed in map catalogs available within the division support command, the corps map depot, and the engineer and G2 staffs at division and corps.

COMMAND AND CONTROL

Command

Squad-sized engineer elements may be attached in order to support the dispersed maneuver companies. Corps engineer assistance will be placed under OPCON of the brigade engineers and distributed within the brigade area.

Control

Control problems for the company commander and the platoon leader will be

complicated. There will probably not be sufficient radios for all these teams and radio communications may be very poor within a built-up area due to the line of sight characteristics for our FM communications equipment. The corps engineer company will be assigned to areas which include the city outskirts and inner-city area and will be fractionalized into squad tasks. There are no radios or other communications authorized to corps combat engineer squads and the only means of communications is messenger or public utility system in the city. Once infantry elements occupy the area, the engineer squads will depend on the infantry elements for communications. Therefore, well-trained, well-briefed teams are essential. These teams in all likelihood will have to operate semi-independently and must understand their missions and be properly

trained to accomplish them. The small unit leader down to the squad and team leader will bear the brunt of the combat and he must be trained and have a properly trained team.

The coordination between the maneuver unit and the engineer unit in planning, implementation, and execution is critical. Finite plans must be developed which spell out obstacle support required and procedures for execution and turnover of targets. This is critical when the tactical force is not physically in the obstacle area and the engineers are executing the plan with the tactical unit. Without effective communications in these areas, considerable engineer resources might be lost because targets/fortifications were not properly sited or turned over as completed.



Appendix F

RIVER CROSSING OPERATIONS

This appendix will give the engineer commander and his staff current insights into their role during the conduct of River Crossing Operations. It addresses both the offensive and the retrograde river crossing and, using a practical exercise, explains the planning steps in further detail.

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INTRODUCTION

River crossing operations are conducted as part of a tactical operation and are not tactical missions in themselves. They are conducted with speed and aggressiveness in order to mass combat power on the exit bank of a river obstacle in sufficient quantity to continue an offensive operation. During a retrograde, river crossing operations are conducted in order to use the river as a natural obstacle, placing it between the enemy and the withdrawing forces.

Two types of crossing are conducted, the determining factors of which include the friendly and enemy mobility, enemy strength, river conditions, and the required crossing speed. These two types are the hasty and the deliberate crossings.

The river crossing, either hasty or deliberate, is a special operation, planned as a part of and in conjunction with future operations. A detailed discussion of doctrine and techniques for river crossing is found in FM 90-13, River Crossing Operations.

COMMAND AND CONTROL

Command and control during the river crossing is perhaps the most difficult function of the operation. Centralized command of the operation insures coordination of support and assault forces. Positive control of crossing elements while concentrating, moving across, and dispersing increases the probability of success. However, there must be sufficient flexibility to permit adjustments in the plan and changes during execution.

A crossing force commander is designated to plan and control the river crossing operation. In a division crossing, the division commander may assume that position or, more likely, he may designate his assistant division commander (ADC) for maneuver. This will allow the division commander to command all aspects of the division's operation. The crossing force commander then has overall control of the river crossing operation.

The crossing force commander is assisted by a crossing force headquarters which

includes an engineer element. When nondivisional engineer support is involved in the river crossing, the commander of the supporting engineer group or brigade should be designated as the crossing force engineer.

The crossing area commander is the designated representative of the crossing force commander to control the movement of the attacking force through the crossing area. Normally this function is performed by brigade executive officers. Engineers, military police, and security forces normally will be temporarily attached as his staff.

It is the responsibility of the crossing area commander to insure the continuous and orderly flow of the fighting elements across the river. He and his staff must be thoroughly familiar with the commander's tactical plan to insure that the crossing operation supports that plan. The crossing area commander controls:

- The engineer regulating points
- The holding areas
- The military police checkpoints
- The crossing sites. (These sites are commanded by engineers who operate the crossing means.)

The crossing area commander's staff engineer, who may be the commander of a nondivisional combat battalion, will advise him on matters related to road maintenance, engineer regulating points, operation of river crossing equipment, and establishment of engineer equipment parks. Normally, the division engineer battalion is focusing attention on providing support to the maneuver elements beyond the river obstacle.

HASTY RIVER CROSSING

Hasty river crossings are planned, decentralized operations using organic, existing, or expedient means. They are conducted as a continuation of the attack with little or no loss of momentum by the attacking force. A hasty crossing is preferred over a deliberate crossing. They are feasible when enemy defenses are weak or can be overcome by fires, and when maneuver forces are equipped to rapidly advance, cross, and continue the attack.

Hasty river crossings are characterized by:

- Speed, surprise, and a minimum loss of momentum.
- Decentralized operations with organic, existing, or expedient resources.
- Weak enemy defenses on both banks.
- Minimum concentration of forces, hence less vulnerability.
- A quick continuation of the attack.

A hasty crossing does not require that all enemy forces be cleared from the river line. It capitalizes on the enemy's confusion and lack of sufficient combat power to oppose the crossing. The initial assault in a hasty river crossing is conducted following the rupture of the enemy forces on the entry bank. The assault forces move across the river, using amphibious and expedient crossing means to

the maximum. For this reason, the brigade engineer and the engineer platoon leaders with the assault task forces will play a major supporting role in the initial phases of the hasty crossing.

The initial crossing forces use intact bridges or employ assault boats, amphibious vehicles and fords in order to cross the maximum amount of firepower possible. Ford sites are selected and marked. The capacity and life of these sites are determined and alternate sites are identified. Amphibious vehicles' entry and exit sites are identified and prepared. Relevant aids to amphibious and recovery vehicles are planned. Engineer tasks on the exit bank are identified and planned. Divisional engineers will normally select and prepare these sites. If nondivisional engineers are present, precise allocation of tasks between divisional and nondivisional engineer units is situation dependent.

PLANNING FOR A HASTY RIVER CROSSING

BRIGADE ENGINEER

Know the terrain that lies ahead (50 km ahead)
Know the commander's plan (plan 3 days ahead)

Select map of potential crossing sites (2 days ahead)

Know equipment available
(36 hours ahead)

Request additional equipment and personnel from division (24 hours ahead)

Insure required items in hands of crossing units (6 hours ahead)

COORDINATE WITH

Brigade S2, Brigade S3, ALO
Engr Bn S2, Engr Platoon Leaders
Brigade S3, Engr Platoon Leaders

Brigade S2, Brigade S3
Engr Bn S2, Engr Platoon Leaders

Engr Bn S3, Engr Bn S4
Engr Platoon Leaders

Brigade S3, Brigade S4

Engr Bn S3, S4, Corps Engineer,
Brigade S3, Brigade S4, Engineer
Platoon Leaders

COMPARISON OF HASTY VS DELIBERATE CROSSING

ITEM	HASTY	DELIBERATE
1. Sp Equip	Organic	Corps
2. Momentum	Maintained	Planned phases
3. Near bank cleared	Partial	Division
4. Crossing Unit	Brigade	Coordinated on order
5. Time of Crossing	Continuation of attack	Near bank
6. LD	Back from river	Multiphase
7. Control Measures	Single phase	Centralized
8. Latitude	Decentralized	Designated on order
9. Time of Attack	Continuation of attack	Scheduled fires
10. Arty Support	On call	

DELIBERATE RIVER CROSSINGS

Deliberate river crossings are required when a hasty crossing is not feasible, has failed, or when offensive operations commence at the river line.

They are characterized by:

- Failure or infeasibility of a hasty crossing.
- Detailed planning and centralized control.
- A deliberate pause short of the entry bank to prepare and build up combat power.
- Concentration of combat power.
- Clearance of enemy forces from the river line.

From the standpoint of engineer effort, the deliberate crossing can be divided into the following three phases:

- 1 Assault phase, conducted using organic vehicles and assault boats
- 2 Rafting phase
- 3 Bridging phase

Plans for a deliberate crossing generally provide for more centralized control of crossing means, fire support, and crossing times of assault and support elements than

for a hasty crossing. A deliberate crossing is required when prevailing conditions preclude the execution of a hasty crossing. This generally means that the enemy defenses are very strong or that the river obstacle is very severe and cannot be crossed by expedient means.

In the assault phase of a deliberate river crossing, there is less emphasis on the entry bank preparation by the divisional engineer units and increased support and assumption of responsibility by nondivisional bridge companies and combat battalions.

In the deliberate crossing, the brigade engineer shifts his focus from the entry bank to the exit bank, but he must still—

- Recommend selection of crossing sites within designated sectors.
- Plan for use of fords.
- Plan for aids to amphibians.
- Assist in development of the river crossing plan.

An engineer combat group will normally be assigned the mission of supporting a division in a deliberate river crossing and the group commander is normally designated as the crossing force engineer on the staff of the crossing commander. In turn, battalion commanders are designated crossing area engineers.

In the brigade area, these engineers can normally be expected to—

- Prepare and operate ford sites.
- Prepare and operate amphibious crossing sites.
- Provide and man pneumatic assault boats.
- Progressively assume responsibilities on the far shore as the attack progresses.

The maneuver brigade engineer should—

- Concentrate on tasks at and beyond the exit bank.
- Nominate to the division engineer tasks he cannot accomplish within his own resources.
- Act as liaison between the nondivisional engineers and the brigade commander.
- Advise the brigade commander on the status of engineer support within the brigade crossing zones.

The divisional engineer units normally will go across the river with the assault units which they support.

In planning the assault, the brigade engineer should allow time for—

- Issue, check, and allocation of pneumatic assault boats.
- Rehearsal of the crossing.
- Briefing of the amphibious vehicle drivers.
- Inspection of amphibious vehicles.

Plan for:

- Control during movement to the river line.
- Control as the boats cross the river.
- Concealed boat assembly areas.
- Noise and light discipline during inflation of boats.
- Control at fords and amphibious crossing sites.

- Entry and exit bank recovery teams.
- Control on the exit bank.
- Aids to amphibians on the exit bank.

After the initial assault has cleared the exit bank of direct fire weapons, engineer units will begin rafting and bridging operations. The essential requirement is to move combat firepower to the exit bank at a rate faster than the enemy can concentrate his own forces for a counterattack. To accomplish this, the tactical commander may elect to first construct rafts with bridge construction to follow when observed indirect fire has been eliminated.

Analysis of the tactical situation may, however, allow for the decision to eliminate the rafting phase and go directly into bridge construction. This is particularly true when considering the speed of employment of modern equipment like the mobile assault bridge and the ribbon bridge.

Factors to be considered in evaluating these alternatives are:

- The opposing force capability to fire on crossing sites.
- Types of crossing equipment.
- Crossing sites available, number, location, and quality.
- Size and location.
- Characteristics of the water obstacle.

For initial planning, two rafting sites per assaulting brigade should be established. This is not a hard and fast rule but is situation dependent, based on the factors mentioned above.

The advantages of raft construction are speed of construction and reduced vulnerability. This includes the ability to move the rafting site. The obvious disadvantage is the relatively slow crossing speed. Priority of construction effort should be placed on raft construction capable of carrying tanks. For this reason, rafts capable of heavy loads should be constructed first.

TASK	DIVISIONAL ENGINEERS	NONDIVISIONAL
Select and make reconnaissance of crossing sites	Commanders, with advice from the brigade and division engineer make initial selection based on tactical plan. Engineer platoon leaders with forward battalions with assistance from the battalion S2, make initial ground reconnaissance of the sites	
Determine bridging and rafting equipment requirements	Coordinates to determine bridge requirements	Maintenance, upgrade and operation
Prepare crossing sites	Quick-fix to make immediately usable	Install, operate and maintain
Install floating equipment	May assist nondivisional engineers. Will advise nondivisional units as to when, where, and how much equipment	
Install aids to amphibians (winches, cables)	Determine requirements. Install entry bank quickly	Operate and maintain
Make vehicle recovery	Exit bank responsibility	Entry bank responsibility
Perform exit bank engineer tasks	Primarily responsible during the assault	Takes over after bridgehead is established

Engineer equipment parks and construction sites assume greater importance when rafting with M4T6 or class 60 equipment than with ribbon or mobile assault bridging. M4T6 and class 60 rafts require large construction sites (36 m x 40 m), additional equipment (one crane and one air compressor), and access to the water line. These sites should be well drained and have equipment turnaround areas.

Some of the disadvantages of construction time associated with the M4T6 and class 60 may be overcome by preassembly of the pontons in a rear area. The preassembled loads may then be brought forward by combat loading on the bridge trucks or by the use of helicopters.

If rafts are to be used in the crossing plan, then the raft scheduling should be completed and coordinated with the tactical commander prior to the assault. Once the tactical commander has become engaged on the far bank, he must have a reasonable ability to anticipate when badly needed items of combat power will arrive on the far bank.

The raft schedule can take several different forms, but it always displays in a tabular form entry bank departure time, river crossing time, arrival time, and load for each raft used in the crossing.

RAFT	ASSEMBLY TIMES FOR DIVISION LOADS
MAB	15 minutes (6 bay)
Ribbon	15 minutes (5 bay)
M4T6	3 hours (5 float reinforced)

Rafting is only a temporary method of moving firepower to the far bank. It should cease once this equipment has been moved.

For planning purposes, bridges should be constructed to move the elements of the brigade trains and other follow-on units. If sufficient equipment is available, rafting operations may continue while replacement bridges are under construction. The rafts may later be incorporated into the bridges or may be removed.

Bridges normally are allocated on a basis of one bridge per assaulting brigade or two bridges per division. These bridges are erected by nondivisional engineer units.

The M4T6 floating bridge, Class 60 floating bridge, ribbon bridge, and MAB are all suitable for use in bridge construction. Actual selection of equipment is dependent upon equipment available, stream characteristics, and the tactical situation. However, consideration must be given to bridge support of the attacking elements. In this regard, it is most desirable for the MAB to be free for forward movement because of its emplacement speed and mobility. The next most desirable bridges for such movement are the ribbon, M4T6, and Class 60, in that order.

Traffic control up to and through the crossing area is a critical problem in crossing operations. For this reason, plans for movement must be detailed and control of movement must be positive. This control is exercised by the assault force commander, the crossing area commander, and traffic headquarters.

As a general rule, engineer movement control responsibilities on the near bank will be the responsibility of the nondivisional engineer unit supporting the river crossing. Exit bank responsibilities will be assumed by divisional units.

Dispersion of engineer equipment is essential on the modern battlefield. The enemy possesses the capability to detect and strike not only the equipment on the water line but also that located in equipment parks and bridge dumps. For this reason, engineer planning should give consideration to:

- Rear area preassembly sites to reduce time on the water line.
- Alternate raft and bridge sites to accommodate movement of the crossing equipment. At the brigade level, two alternate rafting sites and one alternate bridge site should be selected and prepared as equipment and manpower allow.

- Location of equipment parks should be at least 1 kilometer, but not over 5 kilometers, from the water line.
- Bridges, when not in use, can be broken in the middle and swung to the shore to reduce vulnerability.
- Flow of traffic across the water must be rapid and orderly. Buildup of equipment on the waterline cannot be permitted.

Intelligence collection must begin several days prior to reaching the water obstacle for it is in this period that selection of actual and potential crossing sites will be made. Brigade engineers working with the brigade and engineer battalion intelligence officers should begin to accumulate data as soon as the crossing appears imminent.

WHAT YOU MUST KNOW

River Characteristics:

- width
- depth
- velocity
- seasonal high water
- tidal variations
- flood variations
- bottom conditions

Existing bridges

Existing piers

Existing ford and ferry sites

Location of engineer materials

River restrictions

Enemy obstacles:

- on entry bank
- on exit bank
- in the water

This information can be obtained from the theater army engineer topographic battalion. The corps terrain analysis teams, which are DS to the division engineer battalion, should be contacted first for this information. Reconnaissance teams and division intelligence are other sources for this information.

Communications planning is continuous and is concurrent with tactical planning. The added dimension of the crossing area command net places strain on the available

means of radio communications. At the brigade level, the division engineer company may be required to function constantly within the brigade command net as well as the crossing area commander's net. This is in addition to his own company and battalion nets. This problem also occurs at the battalion level and with nondivisional engineers working in the crossing area. Locally developed SOPs should include allocation of communications equipment for river crossing. In addition, maximum use of wire and messenger communications is essential for proper command and control of the river crossing operation.

RETROGRADE RIVER CROSSING

Purpose and Characteristics

A retrograde river crossing is applicable when enemy advances threaten to overwhelm the division, causing it to retrograde and subjecting it to an enemy pursuit. In this situation, the retrograde crossing is conducted to—

- Use the river as a natural obstacle between the withdrawing force and the pursuing enemy.
- Establish the defense on the exit bank.
- Continue the retrograde to defensive positions beyond the water obstacle.

The retrograde crossing is characterized by:

- Detailed planning and centralized control.
- Enemy control of maneuver initiative.
- High risk to friendly forces.
- Forces on exit bank providing overwatching fires.
- Forces delaying enemy's advances to trade space for time at the crossing sites.

In a retrograde river crossing, both banks of the river are initially under friendly control. Existing crossing facilities will be used to the maximum extent possible. Tactical bridging will be used to supplement these facilities.

MOBILE ASSAULT BRIDGE (MAB) CAPABILITIES					
ALLOCATION/ TRANSPORTATION	CAPABILITIES	ASSEMBLY 0.75 76-160m 161-300m		CAPACITY	
● When equipped w/MAB div engr bn - 16 interior bays - 8 end bays ● 212m per corps MAB co - 24 interior bays - 12 end bays ● All units are SP ● Movement size: - 12.8m (42 ft) long - 3.7m (12 ft) high - 3.7m (12 ft) wide - 12.2m turn radius - Int bay - 24T-CL21 - End bay - 27T-CL23 ● Speed - Highway - 65 kmph - Offroad - 10 kmph	● <u>BRIDGE</u> ● = Interior bays = $\frac{\text{Gap(m)}-20}{8}$ ● Anchorage by prop and/or fluke anchor ● <u>RAFTS</u> ● 2 units (end bays) CL 25 ● 3 units, CL 40 ● 4 units, CL 60 ● 5 units, CL 60+ ● 6 units, CL 60+	● 2/3 hr 1hr 2 hr ● Average rate is 150m of brg per hr ● TIME 6 min 8 min 10 min 12 min 14 min		● 200 veh per hr w/30m spacing and 16 kmph - CL 62 in currents <2mps - CL 55 in currents > 2 <3mps ● Currents > 4 may require additional anchorage ● CLASS SHORT TONS LOAD SPACE 36 36 8.5m 47 54 16.5m 60 72 24.5m 60+ 90 32.3m 60+ 108 40.3m	

Engineer Responsibilities

Normally, division engineer units will be committed to the performance of engineer tasks in support of the withdrawing forces. For this reason, nondivisional engineer resources should be used to provide the crossing means for the withdrawing forces. Existing structures are always the preferred crossing means for the withdrawing units. If these facilities are inadequate, supplementary equipment should be used in the order of MAB, ribbon bridge, and M4T6 bridge. These priorities are based on the time

required for withdrawal of the equipment from the river. Although the installation of these bridges will likely be the responsibility of nondivisional engineer units, division bridge assets will sometimes be required.

The crossing force engineer will be responsible for developing a crossing plan that specifies the type of bridging or crossing means to be employed. The general considerations that apply in determining crossing means to be employed are shown in the following table:

CROSSING SEQUENCE				
SEQUENCE	FRIENDLY ACTION	ALTERNATIVE	ENEMY ACTION	SUITABLE EQUIPMENT OR SITE
1	Initial evacuation	Permanent bridge Tactical bridge Fording	Offensive action begins	Existing bridge MAB, ribbon or LTR bridges Fording site
2	Final evacuation of all nonamphibious vehicles	Rafts Fording	Enemy has indirect fire capability on crossing sites.	Existing ferries MAB, ribbon bridge LTR rafts Fording site
3	Final evacuation of amphibians	Vehicle swimming Fording	Enemy has direct fire capability on crossing sites.	Swim sites Fording sites
4	Final evacuation of personnel	Boats Fording Aircraft		Assault Boats Fording sites Helicopters

In developing his crossing plan, the crossing force engineer should consider all existing facilities and all tactical crossing means available for his use. It is very likely that all of them might be used during the course of the operations. The manner in which each would be used should be specified in the operation plan for the crossing. One possible sequence is shown in the accompanying tables.

Obviously complete variation of this sequence might be necessary to meet the requirements of a particular situation. Such factors as the size of the crossing force, the time available, and the enemy situation must be considered. The crossing force engineer recommends the procedure to follow after making an evaluation of the situation. Removal or destruction of equipment is a tactical decision for which there is no

pre-established engineer doctrine. If the conditions for disassembly or destruction are not specified in the operations plan, the crossing means must be disassembled or destroyed on order. Such an order should originate from the headquarters controlling the operation (corps or division) and is usually transmitted through the crossing area commanders. Strict control is critical. Orders should be as comprehensive as those for reserved demolitions to insure that a change of sequencing does not occur early, trapping portions of the force on the far bank, and that bridges and/or items of equipment are not captured intact by the enemy.

NIGHT OPERATIONS AND WORK-SITE SECURITY

On the modern battlefield, engineers must be capable of sustained operations to insure timely construction of crossing equipment. This means that night operations may well be the norm rather than the exception. Some degradation of efficiency cannot be avoided during nighttime operations; it can, however, be kept to the minimum by detailed planning and realistic training.

In most cases, engineers are expected to provide their own worksite security since, in a deliberate river crossing, the entry bank is cleared of enemy forces. An assessment of the Threat and its impact upon timely completion of the crossing must be made. It then becomes the responsibility of the tactical commander to decide what security forces are required. Engineers are trained and expected to defend their sites, provided the situation will allow this deterioration of engineer effort.

As a general rule the tactical commander is responsible for the units operating within his area. Where a Threat exists he insures adequate fire support and reaction forces are available. Nondivisional engineer units should coordinate with the crossing area commander within the crossing area for security forces. Outside the crossing area, the brigade or divisional engineer acts as liaison between nondivisional units and the brigade or division commander.

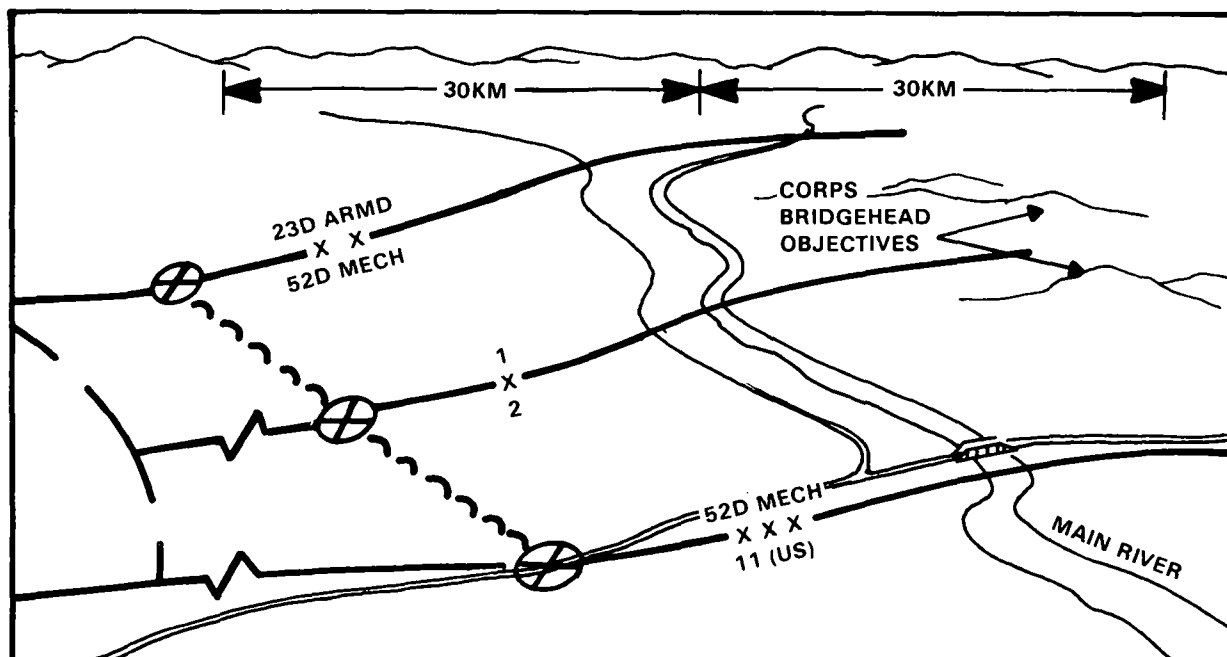
To carry a class 60 load under stated current conditions requires a five-float longitudinal raft. Each raft requires two bridge erection boats for propulsion. Our company has enough equipment to construct and operate six such rafts. All can be built simultaneously. Construction time is 15 minutes. Once completed, each raft can make six round trips per hour across a 150 m river. Our crossing rate is thus 30 class 60 vehicles per hour.	<i>Ribbon/ Bridge Rafts</i>
To carry a class 60 load with M4T6 equipment requires a five float reinforced raft. Since it takes two 27-ft bridge erection boats to propel each raft, and our bridge company has only 10 such boats, five rafts can be used to carry our vehicles. It takes one line platoon to build a raft. Our two line companies can thus build all 5 rafts simultaneously. Construction time is 3 hours. Once completed, each raft can make six round trips per hour across a 150 m river. Our crossing rate is thus 36 class 60 vehicles per hour.	<i>M4T6 Rafts</i>
Our ribbon bridge company has enough equipment to build only one bridge across a 200 m river. Its organic personnel can construct a 200 m bridge in one hour. Once constructed, our bridge can cross vehicles at a rate of 200 per hour, keeping 30 m spacing between vehicles.	<i>Ribbon Bridge</i>
Our M4T6 company has enough equipment to build only one bridge across a 200 m river. Our two combat engineer companies can construct a 200 m bridge in 6 hours. Once constructed, our bridge can cross vehicles at a rate of 200 per hour, keeping 30 m spacing between vehicles.	<i>M4T6 Bridge</i>

The results in terms of the total vehicles able to cross the river by each means at hourly intervals after the start of construction look like this:										
CROSSING MEANS	1	2	3	4	5	6	7	8	9	10
M4T6 RAFT	0	0	0	30	60	90	120	150	180	210
RIBBON BRG RAFT	0	36	72	108	144	180	216	242	278	314
MAB RAFT	0	72	144	216	288	360	432	504	576	648
M4T6 BRIDGE	0	0	0		0	0	200	400	600	800
RIBBON BRIDGE	0	200	400	600	800	1000	1200	1400	1600	1800
MAB BRIDGE	0	200	400	600	800	1000	1200	1400	1600	1800

CONSIDERATION OF ALTERNATIVE CROSSING MEANS							
	EXISTING FACILITIES (BRIDGES, FERRIES, ETC.)	TACTICAL BRIDGING	TACTICAL RAFTS	AMPHIBIANS	BOATS	FORDS	HELICOPTERS
Conditions	1) Must be capable of carrying expected traffic. 2) Must be denied to the enemy. 3) Approaches must be suitable.	1) Enemy fires must be suppressed. 2) River characteristics must be suitable for the type of bridge to be used.	1) Enemy fires must be suppressed capabilities 2) River characteristics must be suitable for the type of raft to be used 3) Approaches must be suitable.	1) Only vehicles with amphibious equipment may remain on far side of gap after other crossing means are removed. 2) Suitable crossing sites must be available. 3) Current less than 5 ft./sec.	Only personnel and hand carried equipment can be evacuated.	Suitable crossing sites must be available	1) Sufficient helicopters must be available. 2) Lift capability of helicopters will be limiting factor on what can be evacuated.
Probable Use	Evacuation of main body.	1) Evacuation of main body. 2) Supplement existing crossing facilities.	Evacuation of heavy items during or after dismounting of tactical bridge.	Final withdrawal mechanized elements of covering force.	1) Last resort evacuation of crossing force personnel. 2) Evacuating demolition guards and firing devices.		1) Supplement after-crossing means. 2) Throughout all phases of the retrograde.
Suitable Equipment	NA	MAB Ribbon M4T6 CI 60	MAB, Ribbon LTR M4T6 & CI 60 in exceptional circumstances.	All amphibious vehicles	1) Bridge erection boats 2) Assault boats		Any rotary wing cargo or utility aircraft. NA

PRACTICAL EXERCISE

Following is a practical exercise on river-crossing operations. It is designed for use by engineer officers in planning assault river-crossing operations. The discussion concentrates on site analysis and resource allocation.



GENERAL SITUATION

It is now 11 August. Threat forces crossed the international border on 1 August and NATO contingency plans were activated after an escalation of alert status. The active defensive measures employed by the NATO forces were successful in slowing down the Threat assault and stabilization of the entire front was achieved by 7 Aug. 10 (US) Corps orders the 52d Mech Div to cross the Main River in zone and seize a bridgehead line that runs north-south from HASSFURT to EBRACH by 16 Aug.

The CG, 52d Mech Div, realizes that the success of a river crossing operation hinges on the collection of engineer intelligence as well as the support rendered by combat engineer units during the physical crossing.

STEP 1 RIVER PLANNING DATA

Corps has provided available data on the river in the division sector for analysis by the division engineer and his staff.

STEP 2 SITE EVALUATION

The sites are evaluated from both a technical and tactical standpoint. In making

the selection, consider the following desirable crossing site features:

All sites:

- Good access and egress roads.
- Narrow portion of the river.
- Low river velocity.

- No obstacles.
- Low and firm banks.
- Adequate river depth.
- Cover and concealment.
- Not heavily defended.

Assault crossing sites:

- Located in a salient in the friendly front (loops and bends in the river).
- Dominant terrain on the entry bank.

Raft sites:

- Vicinity of assault crossing sites.
- Downstream from bridge sites.

Float bridge sites:

- Vicinity of raft sites.
- Good assembly areas.
- Good anchorage conditions.

Engineer intelligence on Main River crossing sites in 52d Mech Div sector.

Site 1

Approaches

Length: 1,600 meters

- Dikes on both banks of river are 2 1/2 meters high; 30% slope.
- BERGRHEINFELD has sustained only minor damage and a minimum of work is required to make streets within the town trafficable. Approaches to the demolished bridge have been heavily cratered on both banks of the river.
- Banks are firm on both sides with a 10% near bank, and 30% far bank, slope.
- Both banks are manmade and stable.
- Assembly areas for infantry are available for the northern half of the site.

River Conditions

Depth—3.2 meters in mid-channel.

Width—95 meters.

Velocity—0.6 meters/second.

Shallow water area extends for 700 meters on far bank through site.

Obstacles and Enemy Activities

- Enemy mines have been sown in oxbow on east bank.
- Type and quantity unknown; extensiveness doubted.
- Roads through the oxbow have been subject to demolition.
- Enemy artillery known to be registered on crossroads.

Site 2

Approaches

- Good road parallels near bank with small roads running to the river.
- A footpath runs beside the river for considerable distance.
- Cross-country mobility is reasonable except for escarpment area.
- Exit problems occur due to the old streambed and levee banks.
- Roads are not immediately available on the exit bank.

River Conditions

Depth—MAIN - 4 meters, mid-channel; ALTER MAIN - up to 3 meters in areas colored blue.

Width—MAIN - 105 meters; ALTER MAIN - up to 80 meters.

Velocity—0.7 meters/second.

Levee banks—Good condition of standard design.

Obstacles and Enemy Activities

- Enemy nuisance mining has been detected in vicinity 861387.

- Sandbeds in the exit bank oxbow present little movement problems to track vehicles.
- Village of ROTHLEIN is known enemy registered artillery target.

Site 3

Approaches

- Escarpment problems on entry bank canalize traffic to existing routes.
- Approaches and exits for vehicle ferry are reasonable, although they are subject to enemy activity.
- Bank construction has produced vertical walls where shown on the map.
- Cross-country movement between the road paralleling the river and the home-bank is good. On the exit bank, cross-country mobility is also good through an extensive graveled area.
- Routes are available through the Bauernsee area.
- GARSTADT has been identified as the location of an electronic emission source.

River Conditions

Width—ranges from 103 meters in north to 92 meters in south.

Depth—3.8 meters mid-channel. The WILDER SEE has 1.3 meters' depth.

Velocity—0.7 meters/second.

Levee banks—poor condition, grass covered. Canal piling is still in good condition.

Obstacles and Enemy Activities

- No significant enemy activities reported in this area.
- HERGOLSHAUSEN received a B-52 strike 7 days ago. Parts of the city are impassable.

Site 4

Approaches

- Rugged terrain into valley restricts cross-country mobility.
- Good all-weather road approximately parallels entry bank and, on exit bank, road runs alongside river.
- Route to and from the ferry has suffered minor damage as a result of enemy action.
- Going beyond HIRSCHFELD is reasonable.
- Some problems arise as a result of small streams on home bank side of MAIN.
- Control areas are good.

River Conditions

Depth—Maximum river depth experienced in this area.

Width—87 meters.

Banks—entry-65% slope; exit-28% slope.

Eddy currents occur in vicinity of stream and river confluence at 851336.

Velocity—0.8 meters/second.

Obstacles and Enemy Activities

- No further information.

Site 5

Approaches

- WIPPELD approaches to this crossing may cause considerable congestion on both banks.
- Steep grades make the approach particularly difficult and will canalize movement through cuttings.
- Road networks servicing the site are good. Vehicular ferry access and egress are satisfactory, although the ferry has been sunk in midstream.
- Rembark River flows through

WIPPELD and makes available possible rafting and construction sites.

- Exit conditions are reasonable. Banks have been stabilized and piled in places.

River Conditions

Width—110 meters.

Banks—entry-20%; exit-20%.

Depth—5 meters in mid-channel.

Velocity—0.8 meters/second.

Obstacles and Enemy Activities

- Enemy artillery has been registering crossroads 854307.
- The sunken ferry has settled astride mid-channel.
- Blinder See presents no obstacle to movement of tracked vehicles.
- Canal on exit bank at southern end of site poses night navigational problems.

Site 6

Approaches

- A steep slope comes down to an area approximately 350 meters from the home bank, and on the exit bank, the slope commences very close to the river. Cross-country movement by tracks is difficult.
- Vineyards cover the hills on either side and are terraced.
- Reasonable access is provided to and from the site by all-weather roads which commence by paralleling the river. The approaches to the OBEREISENHEIM ferry have not been damaged on either side. The ferry is not operable, but presents no obstruction.
- Banks are natural with 20% slopes on both sides of the river. Small estuary on either side at the northern extreme of the site can easily be bypassed.

River Conditions

Width—81 meters.

Depth—4.1 meters in mid-channel.

Bottom is unpredictable and requires extensive survey to get a representative profile.

Velocity—0.75 meters/second.

Obstacles and Enemy Activities

- Enemy positions on Terrain Feature B overlook the complete site. Enemy patrols have recently been active in that area.
- Nuisance mining in the vicinity of OTTERSHAUSEN was reported earlier by refugees. Mines were both AT and apers.
- Enemy artillery was observed registering on Hill 268 at 867276.

Site 7

Approaches

- Excellent close-in approaches exist for most of the site, once the escarpment is negotiated. Cross-country mobility is good on the near shore and fair on the far shore.
- Approaches to the ferry are usable with minimum repair necessary for some crater damage.
- The climb up from FAHR westwards will be difficult for wheeled vehicles although tracks should have no problems.
- A good road system services both sides of the river, but the streets through the villages are narrow and winding.

River Conditions

Width—79 meters.

Depth—4.2 meters in mid-channel.

Banks—existing banks are 60% on entry and 22% on exit. Going is good.

Bottom profile is unreliable.

Velocity at 0.81 meters/second.

Obstacles and Enemy Activities

- Terraced vineyards on the exit bank restrict tracked vehicles.
- Some wire obstacles on the outskirts of FAHR will require breaching. Enemy air has caused buildings in northeast FAHR to crumble and restrict movement.

Site 8

Approaches

- Although the approach to the river is canalized, it is in excellent condition and provides a high-speed avenue to the river. A major road and railway make up the approach.
- Ample deployment room exists to the west of ASTHEIM for crossing tasks.
- VOLKACH produces restrictions to movement on the exit bank but, for 300 meters from the river, the terrain is clear except for gardens.
- River bank conditions are good with 10% entry and exit slopes. Banks are composed of stabilized gravel surfaces.
- Control of entry bank approaches is easy from Hill 247 at 864246.

River Conditions

Width—125 meters.

Depth—4.8 meters, mid-channel.

Velocity—0.4 meters/second.

Bottom profile is not determined.

Obstacles and Enemy Activities

- The road and railway bridge demolitions provide obstacles to movement

both laterally and across the river. In the south, the MAINKANAL produces exit problems.

- No enemy activities have been reported
- No enemy activities have been reported in the near vicinity of VOLKACH.

STEP 3 SITE SELECTION

As operations officer of the 52d Engr Bn, you evaluated the sites and selected:

- Two battalion-sized APC assault crossing sites in each brigade area.
- Three heavy raft sites in each brigade area for heavy rafting.
- Two bridge sites for bridging; one site in each brigade area.

Site selection:

- Assault crossing sites: 2, 3, 5, 7.
- Heavy raft sites: 1, 3, 4, 5, 6, 7.
- Bridge sites: 3, 7.

STEP 4 COMMAND GUIDANCE AND ENGINEER RECOMMENDATION

The CG, 52d Mech Div, issues guidance to his staff on the conduct of a deliberate crossing of the MAIN RIVER to seize the corps bridgehead. The division staff, using the commander's guidance, prepares OPLAN 9.

The CG also stresses the importance of the engineer support in rafting and bridging the MAIN and requests the division engineer to prepare the *Estimated Vehicle Crossing Capability Table* and to recommend the best employment of river crossing means and engineer troops.

ORGANIC VEHICLES IN 52d MECHANIZED DIVISION			
UNITS	NO. AM- PHIBIOUS	CL 12 OR LESS	OVER CL 12
Bde HHC	12	17	1
Mech Bn	100	56	20
Armd Bn	39	52	81
Arty Bn (155 SP)	58	42	24
Div Arty less DS (Incl 69th Gp)	224	210	164
123d Cav	122	61	19
Div Trp	85	461	114
DISCOM	32	354	131
Div Tac CP	2	8	2
Div HQ	---	9	11

NOTE:

- Vehicle allocation is for one of each type unit.
- 25% of amphibious are unserviceable. To "worst case" this, they are to be over Class 12 category.

The division engineer, in coordination with the division operations officer, arrived at the following estimated starting times for raft and bridge construction (H hour is the time of crossing the LD):

- Rafts: H + 1
- Bridges: H + 1 1/2

Crossing will take place under favorable daylight conditions.

RAFTING CAPACITY			AVAILABLE CROSSING MEANS				
VEHICLE CARRYING CAPACITY			UNIT	LTR SETS	MAB BAYS	M4T6 SETS	RIBBON BAYS
RAFT (NO.)	> CL 12	> CL 12	Co E, 52d Engr (MAB)	2	16/8	---	---
LTR (8)	8	---	5040th Engr Co (Ribbon)	---	---	---	30/12
MAB (6)	24	12*	5050th Engr Co (Flt Brg)	6	---	5	---
M4T6 (5)	10	5	1st Plt 5070th Engr Co (MAB)	---	8/4	---	---
Ribbon (6)	24	12					
	—	—					
Total	66	29					
*A 6-bay MAB raft can carry two tanks in a single crossing if special precautions are observed.			Total	8	24/12	5	30/12

VEHICLE CROSSING REQUIREMENTS

Unit	Amphibians	Vehicles ≤ CL 12	Vehicles > CL 12	Unit	Amphibians	Vehicles ≤ CL 12	Vehicles > CL 12
1st Bde				1-23 Cav	122	61	19
HHC	12	17	1	25% Adjust.	<u>-31</u>		<u>+ 31</u>
2 x Mech Bn	200	112	40	Adj Total	91	61	50
2 x Armor Bn	78	104	162	Div Trp	85	461	114
1 x Arty Bn	<u>58</u>	<u>42</u>	<u>24</u>	25% Adjust.	<u>-21</u>		<u>+21</u>
Total	348	275	227	Adj Total	64	461	135
25% Adjust	<u>-87</u>		<u>+87</u>	DISCOM	32	354	131
Adj Total	261	275	314	25% Adjust.	<u>-8</u>		<u>+8</u>
2d Bde				Adj Total	24	354	139
HHC	12	17	1	Div Tac CP	2	8	2
3 x Mech Bn	300	168	60	Div HQ		9	11
1 x Armd Bn	39	52	81				
1 x Arty Bn	<u>58</u>	<u>42</u>	<u>24</u>				
	409	279	166	ADJUSTED TOTALS			
25% Adjust	<u>-102</u>		<u>+102</u>	Unit	Amphibians	Vehicles ≤ CL 12	Vehicles > CL 12
Adj Total	307	279	268				
3d Bde				1st Bde	261	275	314
HHC	12	17	1	2d Bde	307	279	268
1 x Mech Bn	100	56	20	3d Bde	113	125	140
1 x Armd Bn	<u>39</u>	<u>52</u>	<u>81</u>	Div Arty	168	210	220
Total	151	125	102	1-23 Cav	91	61	50
25% Adjust.	<u>-38</u>		<u>+38</u>	Div Trp	64	461	135
Adj Total	113	125	140	DISCOM	24	354	139
Div Arty	224	210	164	Div Tac CP	2	8	2
25% Adjust	<u>-56</u>		<u>+56</u>	Div HQ		9	11
Adj Total	168	210	220	Total	1030	1782	1279

VEHICLE CROSSING CAPABILITY

The vehicle capability for four cases is shown in the worksheet below.

CAPABILITY				VEHICLE CROSSING CAPABILITY WORKSHEET										
TRIPS/HR				CYCLE	H	H+1	H+2	H+3	H+4	H+5	H+6	H+7	H+8	H+9
SERIAL DETAIL DAY NIGHT														
All Rafts	8 LTR	8	5	(64)	(32)	(96)	(160)	(224)	(288)	(352)	(416)	(480)	(520)	
	6 MAB	8	5	(192)								(46)	(238)	
				96	64	160	256	352	448	544	640	690		
	5 M4T6	8	5	(80)				(80)	(160)	(240)	(320)	(400)	(480)	
A				40										
	6 RB	8	5	(192)							(160)	(352)	(544)	
				96	64	160	256	352	448	544	560	589		
	Totals				(32)	(96)	(160)	(304)	(448)	(592)	(896)	(1278)	(1782)	
					128	320	512	704	896	1088	1200	1279	Complete at H+9	
Two MAB Brg	8 LTR	8	5	(64)	(32)	(96)	(160)	(224)	(288)	(352)				
	5 M4T6	8	5	(80)				(80)	(160)	(240)				
				40										
	6 RB	8	5	(192)				(32)	(224)	(416)				
B				96	64	160	256	320						
	2 MAB Brg	200	100	400				(241)	(626)	(878)				
						400	800	959						
	Totals				(32)	(96)	(160)	(577)	(1298)	(1886)	Complete at H+6			
					64	560	1056	1279						
Two Ribbon Brg+ Rafts	8 LTR	8	5	64	(32)	(96)	(160)	(224)	(288)	(352)				
	5 M4T6	8	5	(80)				(80)	(160)	(240)				
				40										
	6 MAB	8	5	(192)					(192)	(231)				
C				96	54	160	256	352						
	2 RB	8	5	(32)				(32)	(64)					
	Raft			16	11	27	43							
	2 RB Brg	200	100					(273)	(673)	(981)				
				400		400	800	927						
	Totals				(32)	(96)	(160)	(609)	(1377)	(1804)	Complete at H+6			
					65	587	1099	1279						

NOTE: Figures enclosed in () indicate loads less than Class 12.

VEHICLE CROSSING CAPABILITY

CAPABILITY				VEHICLE CROSSING CAPABILITY WORKSHEET										
TRIPS/HR				CYCLE	H	H+1	H+2	H+3	H+4	H+5	H+6	H+7	H+8	H+9
SERIAL	DETAIL	DAY	NIGHT											
	8 LTR	8	5	(64)	(32)	(96)	(160)	(224)	(280)	(344)				
	6 MAB	8	5	(192)				(22)	(214)	(406)	(575)			
				96	64	160	256	330	330					
1 M4T6	3 RB	8	5	(96)					(96)	(192)				
Brg														
1 Rib-	Rafts			48	32	80	128	176						
bon Brg														
+Rafts	1 RB				---				(51)	(251)	(451)			
	Brg	200	100	200		200	400	600	749					
	4 M4T6	8	5	(64)	---	---	---	(64)	(128)	(192)	(256)			
	Rafts			32										
D	1 M4T6				---	---	---	(100)	(100)	(300)	(500)			
	Brg	200	100	200					200					
	Totals				(32)	(96)	(160)	(410)	(869)	(1685)	(1782)			
					96	440	784	1106	1279					
Complete at H+7														
NOTE: Figures enclosed in () indicate loads less than Class 12.														

Vehicle-crossing capabilities. The Vehicle-crossing Capability Worksheet data reveals that—

- Using assault bridging techniques, the crossing should be complete at H + 6.
- Rafting alone extends the duration of the operation to H + 9.
- The introduction of an MSR-type bridge sees the operation finished at H + 7.

NOTE: Using three bridges, regardless of type, only a marginal time improvement is gained.

The advantages and disadvantages for each case are:

All raft

Advantages

- Flexibility.
- Fairly early buildup of heavy vehicles.
- Least vulnerable method of crossing.

Disadvantages

- Increasing traffic control problems in getting vehicles to many sites.
- Permanent MSR facilities still having to be constructed.

Two MAB bridges + raft

Advantages

- Speed in all aspects.
- Flexibility to change MAB configuration from bridge to raft.
- Assisting in simplifying command and control.

Disadvantages

- Traffic concentration presenting favorable targets.
- Providing bridge suitable for MSR use.

Two Ribbon bridges + raft

Advantages: The same as for the MAB.

Disadvantage: Slower in mode change than MAB.

One M4T6, one Ribbon bridge + rafts

Advantages

- Slow buildup of heavy vehicles.
- Long construction time of M4T6 on river line.

Disadvantage:

- Taking little advantage of assault bridging capability.

Recommendation. Recommend the use of assault bridging (Ribbon) at two sites and the MAB, M4T6, and LTR as rafts. This final decision was based in part on traffic control problems expected to arise once the intermediate objectives have been seized and the problems with lateral movement near the river line on the exit bank.

STEP 5 CROSSING ANALYSIS

- Sites to crossing units.
- Crossing equipment to sites.
- A timetable for the use of the sites.

Details are developed using the following information and the Vehicle-crossing Capability Worksheet:

- Assaulting echelons of the 1st and 2d Brigades contain 60 percent of all serviceable amphibious vehicles. The remaining amphibians in the brigade follow-on echelons can either swim, raft, or cross by bridge. (Use the quickest course of action.)
- Plan on the total complement of 1st and 2d Brigade vehicles crossing prior to any other units using the crossing sites.
- 1-23d Cav follows immediately after 1st Bde. Their vehicles can cross largely under their own means if necessary, but bridging is preferred because of time. Div Tac CP follows after them.
- 3d Brigade follows 2d Brigade and uses all available crossing means in that area.

- Div Arty moves in three groups, one group at a time. In preplanning, assume the groups are not of equal size with two groups crossing in the north (1st Bde area) and one group in the south (2d Bde area).
- The normally associated engineer companies must move with the committed brigades. Vehicle figures are:

Amphibians—10
 Less than Class 12—6
 More than Class 12—

These vehicle figures will have to be adjusted from the Div Trp figures and included with the figures for the supported units.

- LTR: 2 rafts each at Sites 2, 3, 5, 7.
- MAB: 4 rafts (4/2) from 5060th Engr at Site 1; 2 rafts (4/2) from 1/5070th Engr Co at Site 5.
- M4T6: 2 rafts at Site 4; 3 rafts at Site 6.
- Ribbon:
 - *Bridges* at sites 3, 7.
 - *Rafts*: 2 rafts (3/2) one each at Site 3 and Site 7.

This assumption produces a start point that may need revision after further calculations.

Determine vehicle crossing requirements by unit:

1st Bde

Assault: 160 amphibians.

Raft/Bridge: Cl 12: 275

Cl 12: 714 + 101 = 415.

2d Bde

Assault: 185 amphibians.

Raft/Bridge:

Cl 12: 279

Cl 12: 268 + 122 = 390

1-23 Cav

Cl 12: 61

Cl 12: 50 + 91 = 141

3d Bde

Cl 12: 125

Cl 12: 140 + 113 = 253

Div Arty

Cl 12: 210

Cl 12: 220 + 168 = 388

Div Trp

Cl 12: 461

Cl 12: 135 + 64 = 199

Cl 2: 8

CL 12: 8

Cl 12: 4

Div HQ

Cl 12: 9

Cl 12: 11

DISCOM

Cl 12: 354

Cl 12: 163

Refine the crossing sequence:

CROSSING SITES	
1-4	5-7
1 Bde	2 Bde
1/23 Cav	3 Bde
2 Gps Div Arty	1 Gp Arty
Div Tac CP	Div Trp
Div HQ	DISCOM

STEP 6 TASK ALLOCATION

The next step is to produce the total requirement for engineers. Consider the following:

- Troops for combat support.
- Construction crews.
- Operating crews.
- Road maintenance demands.
- Manning of engineer regulating points (ERPs).
- Damage control.

Recommend the command and control systems to be employed within the division for engineer employment.

Prepare the outline for Paragraph 3 of the Engineer Annex to the Division OPLAN.

ENGINEER SUPPORT FOR CROSSING OPERATIONS**1st Bde area (Sites 1-4)**

TASK	MANPOWER	TIME
Construct:		
4 LTR	4 Plt	0.50 hr
4 MAB	Crew	0.25 hr
1 RB Raft	Crew	0.25 hr
2 M4T6	2 Plt	3.00 hr
1 Brg	3 Plt (access work)	0.50 hr
Total	9 plt	

9 Platoons are needed for construction, operation, access work, and boat duties.

2d Bde area: (Sites 5-7)

Same as 1st Bde + 1 additional platoon for one M4T6 raft.

Total: 10 plt, say 11 plt.

Combat support to assaulting brigades and cavalry requires 3 companies ATCH/DS to units.

Other tasks are:

- Road, track, parking area construction.
- Damage control tasks.
- Maintenance of roads and tracks.
- Manning of ERPs.
- Water supply.
- Provision of protective shelters.

Support available from OPLAN 9 is:

52d Engr Bn

60th Engr Gp

500th Engr Bn (Cbt)
 501st Engr Bn (Cbt)
 502d Engr Bn (Cbt)
 5040th Engr Co (Ribbon Brg)
 5050th Engr co (Flt Brg)
 5060th Engr Co (MAB)
 1/5070th Engr Co (MAB)
 5082nd Engr Co (Cbt Spt Equip)

A task allocation then could be:

52d Engr Bn: Combat support to assaulting brigades.

60th Engr Gp: Provide two combat battalions for raft and bridge construction and operation; complete all tasks in "Other Tasks" listed on page F-27; deploy bridging equipment IAW the Crossing Annex details.

Command and Control. From the task allocation, the logical system to be used is to make the 60th Engr Gp commander the crossing force engineer. The 60th Engr Gp will be responsible for all entry bank and water activities. 52d Engr Bn remains responsible for the intimate combat support of the tactical scheme maneuver.

Paragraph 3 of Engineer Annex.

Execution

a. *Concept of Operations.* 60th Engr Gp constructs access to rafts and bridges and operates them throughout the crossing. 52d Engr Bn deploys companies to the cavalry and committed brigades with the remainder in general support of the operation; tasks and priorities detailed in task list.

b. *52d Engr Bn*

1. Provide one company attached to 123d Cavalry and companies in DS to 1st and 2d Bde IAW Task Organization.

2. Coordinate exit bank movement activities with CAC and Tfc HQ.

3. E/52d provides MAB rafts IAW crossing annex.

c. 60th Engr Gp

1. Construct and operate crossing sites IAW Crossing Annex (annex D).

2. Provide all access construction and parking areas on near shore.

3. Deploy and control engineer equipment parks, engineer regulating points. Locations at Annex E - Traffic Control. Coordinate deployment with CACs and Tfc HQ.

4. Be prepared to relieve 52d Engr Bn of far bank tasks.

d. Coordinating Instructions

1. Appendix 1 - Engineer Operation Overlay.

2. Appendix 2 - Task List

3. Task organization effective on "receipt."

Equipment	Capabilities	Formula	Allocation	Transportation
Assault Boats	3,375 lb of equip or 12 infantrymen and 3 engineers with paddles. 12 infantrymen and 2 engineers with outboard.	Usual allocation of 1 boat per squad to maintain squad integrity.	18/div engr bn 70/corps flt brg co	20 deflated boats/2 1/2 ton truck.
Armored Personnel Carrier	Can move 1 squad of combat-equipped troops.	$\text{Drift} = \frac{\text{Current (mps)}}{1.6}$ $\times \text{river width (m)}$	10/engr co (mech) 20/mech co 2/armd co	Self-propelled.
27-Foot Bridge Erection Boat	Bridge construction/anchorage. Raft propulsion. Max thrust 3,500 lb.		2 boats/M4T6 set. 3 boats/MAB co. 14 boats/Ribbon co.	2 1/2-ton truck + pole trailer or 5 ton bridge truck w/cradle.
Aluminum Footbridge	Foot troops or 1/4-ton truck raft.	$\text{No. of Bays} = \frac{\text{GAP (m)}}{3.4}$	1 set, 472' (144m) per cellular team	1 set on two 2 1/2-ton truck + 2 pole trailers

Construction Time (hr) Speed Width ft (m) 0-250 250-525 525-1000 (0-75) (75-150) (160-300)	Propulsion	Crossing Speed (w) Full Load	Limitations	References	Remarks
Hand pumped 10 min	Paddles 25 hp outboard	5 fps (1.5 mps) 15 fps (4.6 mps)	Subject to puncture. Currents > 5mps Currents > 11fps	TM 5-210 p. 3-3 FM 90-13	Rehearsals desirable prior to use with untrained troops.
	Tracks only	5.3 mps (1.6 mps)	Banks < 18" Currents Draft 60" (1.5 m) Noise	None	Other div amphib veh: gama goat and 155mm SP. All have limited exiting capabilities.
With crane/wrecker 20-30 min Straight launch 5 min	2-90 hp marine drive engines	27 fps (8 mps) unloaded and negligible current	Draft 40" (1 m)	TM 5-210 p. 3-5	Can carry 9 cbt loaded troops or 3,000 lbs of cargo
1 plt 1 plt 1/2 hr 1 hr	25 hp outboard used on raft	75 troops/min (day) 25 troops/min (blackout)	Current 8-11 fps— (2.5-3mps) capacity lowered by 20%	TM 5-210 p. 4-1 FM 90-13	

Equipment	Capabilities	Formula	Allocation	Transportation
Light Tactical Rafts	1 set has 4 pontoons, 4 deck bays 11'/3.35m ea) 4P3B CI 12 with articulators.		2 sets/ div engr bn (flt brg co)	1 set on two 2 1/2-ton truck + 1 pole trailer
Bridges	44' (13.4m) CI 16 bridge/ set (at 5 fps/ 1.5 mps current)	$\frac{\text{pontoons} = \text{GAP (m)}}{3.35} + 2$		
M4T6 Rafts	4-float normal (N) or reinforced(R) CI 50/55	1 set (9 floats) makes one 4 N raft or one 5 N raft or one 4 R raft and one 5 R raft.	five 5-ton brg trucks per raft	
	5-float normal CI 55/60' 5-float re- inforced CI 60/65	4 set/div engr bn (in CONUS units)	Six 5-ton brg trucks per raft	

Construction Time (hr) Speed Width ft (m) 0-250 250-525 525-1000 (0-75) (75-150) (160-300)	Propulsion	Crossing Speed (w) Full Load	Limitations	References	Remarks
1 plt can build 4P3B raft in 1/3 to 1/2 hour Effective loading length 30 ft (9m)	25 hp outboard motor per pontoon or bridge erection boat or flying ferry (kit organic to set)		Open pontoon can fill with water Draft 24" (0.6m) for OBM Bank heights with artic- ulators +41" (1 m) -19" (0.5 m)	TM 5-210 p. 5-1 FM 90-13	*Articul- ators (length 7'/ 2m may be removed. Class increases by 4. Construc- tion/operat- ing times increase by 50% at night/ adverse conditions
1 plt 2 plt _____ 1 1/2 hr 2 1/2 hr		200 veh/hr 100' (30 m) between veh			Not normally used to build a bridge
1 plt - 2 1/4 hr (daytime)* _____ Eff load lengths: 4N 51'8" (15.8m) 4R 38'4" (11.6m) 1 1/4 hr with pre- assembled loads.		2-27' brg erection boats per raft	Draft load- ed float 30" (0.7 m) Draft bridge erection boat 40"/1m Length of bridge limited by current de- pendent anchorage system.	TM 5-210 p. 6-1 FM 90-13	Fixed span capability -see FM 5-34, p. 198 For div level planning assume each raft carries 1 veh > CI 12 or 2 veh ≤ CI 12. Construc- tion times increase by 50% at night/ad- verse con- ditions
1 plt - 3 hr (daytime)* _____ Eff load lengths: 5N 66'8" (20.4m) 5R 50'4" (15.2m) *1 1/2 hr with pre- assembled loads.					

Equipment	Capabilities	Formula	Allocation	Trans portation
M4T6 Bridges	Carries divisional loads in normal or reinforced construction (dependent on current).	Normal con- struc- tion *Floats = $\frac{\text{GAP (m)} + 2 + 10\%}{4.6}$ Reinforced construc- tion* Floats = $\frac{\text{GAP (m)}}{3} + 10\%$ (2/3 offset saddles)	5 sets/ corps fltbrg co (2 BEB/set)	1 brg truck for each 15'/4.6m bay 12 brg trucks per set with accessories.
Class 60 Rafts	4 float normal CI 40/45. 5 float normal CI 50/55 5 float reinforced CI 55/60 6 float reinforced CI 65/75	1 set normally provides only 1 raft as there are only 2 ramps.		5 brg trucks 6 brg trucks 6 brg trucks 7 brg trucks

Construction Time (hr) Speed Width ft (m) 0-250 250-525 525-1000 (0-75) (75-150) (160-300)	Propulsion	Crossing Speed (w) Full Load	Limitations	References	Remarks
1 co 2 co 2 co to 1 bn 3 hrs 6 hrs 10 hrs Construction Sites 2 3-5 6		200 veh/hr 100' between veh. Max speed 25 mph (40 kph)	Air compressor, cranes needed for assembly.		Construction times increase by 50% at night/adverse conditions.
1 plt - 1 1/2 hr Eff load length - 51' (15 m) 1 plt - 1 3/4 hr Eff load length - 66' (20 m) 1 plt 1 3/4 hr Eff load length - 51' (15 m) 1 plt - 2 hr Eff load length - 54' (16 m)	2-27' brg erection boats per raft.		draft loaded float-30" Draft bridge erection boat 40". Cranes and air compressors needed for assembly.	TM 5-210, p. 7-1	No longer standard A. Construction times increase by 50% at night/adverse conditions.

Equipment	Capabilities	Formula	Allocation	Trans portation
Class 60 Bridges	Carries divisional loads in normal or reinforced construction (dependent on current).	Normal construc- tion no. $\frac{\text{GAP (m)}}{4.6}$ +4 + 10% Rein- forced construction. $\frac{\text{GAP (m)}}{3} + 10\%$	5 sets/ corps fltbrg. co	1 brg truck for each 15' brg. 12 brg trucks per set with accessories.
MAB Rafts	2 end bays CI 25	Eff load 8m	16 int and 8 end bays per div engr bn. 24 int and 12 end bays per corps aslt brg co.	Self-propelled
	1 int bay 2 end bays CI 40	17m		
	2 int bays 2 end bays CI 60	24m		
	3 int bays 2 end bays CI 60	32m		
	4 int bays 2 end bays CI 60	40m		
	Bridge	No. Int bays = $\frac{\text{GAP (m)} - 20}{8}$		
RIB BON	Rafts		Ribbon brg co has 30 int bays, 12 ramp bays, and 14 BEB on 5-ton brg truck w/ cradle	1 transporter bay (modified) 5-ton brg trk)
	Bridge	See page F-36 No. Int bays = $\frac{6.7}{\text{GAP (m)} - 14}$		

Construction Time (hr) Speed Width ft (m) 0-250 250-525 525-1000 (0-75) (75-150) (160-300)	Propulsion	Crossing Speed (w) Full Load	Limitations	References	Remarks
2 co to 1 co 2 co 1 bn ----- 3 hrs 5 hrs 8 hrs Construction Sites 2 3-5 6	200 veh/hr 100' (30 m) between veh. Max speed 25 mph (40 Kmph)				
Crew ----- 6 min	335 hp eng in each unit driv- ing 4 wheels on land fully rotating prop in water	11fps/3.5 mps	Veh size on land. 42'/ 13m long 12'/3.7m wide 12'/3.7m high Draft of loaded MAB is 42"/1m. 60"/1.5m of water re- quired for full power.	TM 5-210 p. 9-1 FM 90-13	
Crew ----- 8 min					
Crew ----- 10 min					
Crew ----- 12 min					
Crew ----- 15 min					
Crew Crew Crew ----- 2/3 1 hr 2 hr	27' brg erection boats	Maximum 200 veh/ hr 30 m between veh at max speed 25 mph/ 40kph			
10-20 min raft					
10'(3 m) per minute		See page	Draft of loaded pon- ton is 24"/ 0.6m Draft of bridge erec- tion boat is 40"/1m	TM 5-5420 209-12.	Ribbon bridge co hauls, main- tains, and constructs this equip- ment. Additional mission of cargo hauling.

Equipment	Capabilities	Formula	Allocation	Trans portation
Armored Vehicle-launched Bridge	63'/19.2m long CI 60 bridge spans 60'/18.3m on concrete abutments (57'/17.4m on unprepared abutments).		4 carriers 6 bridges per div engr bn. 2 carriers 2 bridges per Armd bn.	Carriers M48 and M60

CROSSING CAPABILITIES OF RAFTS AND FERRIES

Ribbon, MAB, CL 60, M4T6, LTR	Stream Width Meters (Feet)					
	70(230')	100(328')	150(492')	300(984')	450(1476')	1200(3936')
Round trip in minutes for currents up to 5 fps.	7	7	10	15	20	60
Max number of rafts per centerline	1	1	2	3-5	5-7	10-15

Construction Time (hr) Speed Width ft (m) 0-250 250-525 525-1000 (0-75) (75-150) (160-300)	Propulsion	Crossing Speed (w) Full Load	Limitations	References	Remarks
5 minutes		1 veh at a time		FM 90-13	

RIBBON RAFTING — NORMAL LOADS										
RAFT	LENGTH for LOADING		STREAM VELOCITY						REMARKS	
			0-1.2 (MPS)	1.5 (MPS)	1.8 (MPS)	2.1 (MPS)	2.4 (MPS)	2.7 (MPS)		3 (MPS)
	Meters	Feet	0-4 (FPS)	5 (FPS)	6 (FPS)	7 (FPS)	8 (FPS)	9 (FPS)	10 (FPS)	
3 Bay (1 int, 2 ramps)	6.7	22	45/2	45/2	40/2	40/2	35/2	30/2	25/2	See Notes 1 and 3
4 Bay (2 int, 2 ramp)	13.4	44	60/2	60/2	60/2	60/2	60/2		45/2	See Notes 1 and 3
5 Bay (3 int, 2 ramps)	20	66	70/2	70/2	70/2	70/2	70/2	60/2	50/2	See Notes 1 and 3

- NOTES:
- 1. Load class based on tracked vehicles.
Number of 27-foot bridge erection boats to propel raft.
 - 2. Ramp bay angle is 8 degrees.
 - 3. Erection boats provide enough power to move rafts across water with the given velocities and with little downstream drift.

50/2

RIBBON BRIDGE LOADS							
TYPE	STREAM VELOCITY		LOAD CLASS	VEHICLE SPACING		FREEBOARD	
	METERS	FEET		METERS	FEET	CENTIMETERS	INCHES
Normal	0	0	75	30	100	0	0
	1.8	6	65	30	100	0	0
	2.4	8	60	30	100	0	0
	2.7	9	45	46	150	5	0
Caution	0	0	80	46	150	-5	-2
	1.8	6	70	46	150	-5	-2
	2.4	8	65	46	150	-5	-2
	2.7	9	50	46	150	-5	-2

- NOTES:
- 1. Maximum speeds for normal crossings.
 - a. On ramps: Class 40 loads or under - 24 kilometers (15 miles) per hour.
Over class 40 loads - 8 kilometers (5 miles) per hour.
 - b. On bridge: Class 40 loads or under - 40 kilometers (25 miles) per hour.
Over class 40 loads - 24 kilometers (15 miles) per hour.
 - 2. Maximum speed for caution crossings.
 - a. On ramps: All loads - 8 kilometers (5 miles) per hour or less.
 - b. On bridge: All loads - 13 kilometers (8 miles) per hour or less.
 - 3. Load class is based on tracked vehicles.
 - 4. Overhead cable anchorage is used, but load class would be about the same using boats for anchorage.

CROSSING RATE: 200 veh/hr
30 m between
veh at max
speed 25 mph

Appendix G OPERATIONS IN SPECIAL ENVIRONMENT

Unfamiliar environmental conditions can severely impact on engineer operations. Although engineer units are equipped for employment within a wide range of conditions, environmental extremes frequently require specialized equipment, techniques, and procedures. Engineer commanders and staff sections of all echelons must study environmental factors to determine how troops should be trained, equipped, and employed

This appendix covers only briefly some of the more important considerations of combat engineer units employed in support of special operations.

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Section 1

NORTHERN OPERATIONS

GENERAL

Northern regions comprise about 45 percent of the North American continent and 65 percent of the Eurasian landmass (fig. G-1). These regions are characterized by deep snow, permafrost, seasonally frozen ground, frozen lakes and rivers, glaciers, and extreme cold. Besides the climatic effects, military operations are also influenced by the vast distances and isolation common to these areas. The adverse effects of these characteristics can be offset to some extent by extensive training and equipment modification.

SEASONAL VARIATIONS

During the winter, cold, snow, frozen waterways, permafrost, frequent high winds, and continuous darkness or short periods of daylight prevail. Seasonally frozen ground may exist to depths as great as 4 meters. These factors create problems such as constant need for shelter and heat, increased dependence on service support, and the need for special winter equipment and clothing. Frozen soil significantly increases both the difficulty and required time for the accomplishment of any tasks involving penetration of the ground's surface. The cold greatly enhances the transmission of sound and makes the enforcement of noise discipline in a combat situation all the more important. Deep snow does not necessarily reduce the mobility of properly trained and equipped troops.

During the spring breakup, sudden thaws weaken the ice on waterways and swamps, and make existing roads almost impassable. Chunks of river ice make river crossing operations extremely hazardous. These factors will hamper extensive overland movement.

During the summer, the area may be characterized by numerous and extensive swamps, lakes, and rivers; abundant insects; and, at times, continuous daylight. Special equipment, such as boats and low-ground-pressure tracked vehicles, is needed.

During the fall freezeup, ground and waterways frequently freeze before heavy snow falls. Prior to such snowfall, troops and vehicles can move cross-country with ease.

However, in some cases, early snowfall will insulate the ground and prevent its freezing until late in winter. This condition impedes cross-country mobility.

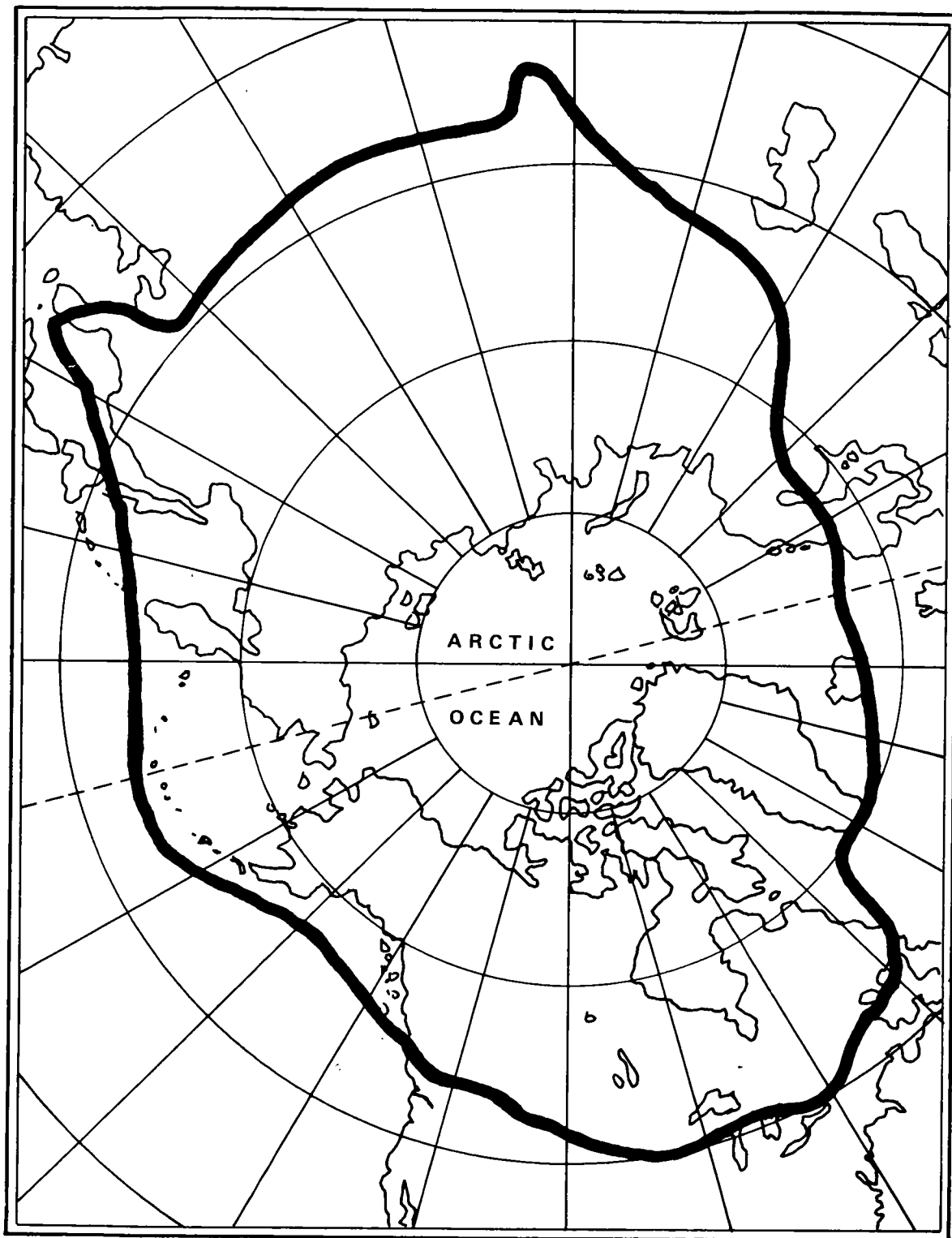


FIGURE G-1. NORTHERN AREAS

EQUIPMENT MODIFICATION

Engineer organizations accustomed to operating in temperate climates can be adapted to northern conditions by modifying the quantity, type, and nature of their equipment and by providing supplemental training to their personnel. In general, the amount of engineer heavy construction equipment must be increased; tracked personnel and cargo carriers must be added; and special purpose equipment (e.g., drills for ice and frozen ground, portable duct heaters, and extra maintenance shelters) added to compensate for the environmental conditions.

Proper maintenance of vehicles and power equipment in very low temperature is difficult. Maintenance work in the open at low temperature is extremely difficult, and heated shelters must be provided. Extreme cold may result in rapid degradation of both metal and plastic parts, due to low temperature embrittlement. Items such as fuel and oil filters, spark plugs, and hydraulic hoses and seals will deteriorate much more rapidly than usual.

MOBILITY

Roads and Trails

- Since routes of communication in most northern areas are generally limited to an extremely primitive road and trail network, a major construction effort to assure movement and resupply is necessary. Full utilization of all military geographic intelligence is mandatory to assure proper route selection and to avoid needless dissipation of construction effort.

- The vast roadless areas of the north become even more difficult for overland vehicular movement under summer conditions than during the winter months when the ground and waterways are frozen. Winter roads generally are constructed on the ice and waterways or across frozen swamps and muskeg areas. Summer routes are selected to follow high ground, flood plains of braided streams, shallow rivers, and shorelines of gravel-bottomed lakes.

- The construction of snow roads for wheeled and tracked vehicles and snow removal or

compaction on all types of roads and trails are important. Satisfactory pioneer roads can be constructed by grading the snow to a depth of 8 to 10 inches and compacting it with a roller. The 13-wheel pneumatic tire roller should be empty on the first pass. Weight is added to the roller with each pass. This process must be repeated after each snowfall.

- Frequently, winter traffic effects on snow roads result in a loose snow-soil mixture which cannot be compacted. If temperatures are sufficiently low, this condition can be corrected by adding water and restoring stability by freezing. In the more common case, traction can be restored only by removing the unstable material.

- Engineer troop units' snow removal capabilities are applied to main routes of communication and the clearing of Army airfields in division and corps areas. Piling of snow or forming snowbanks along the road causes increased drifting of windblown snow up to the height of the snowbanks. Road surfaces, culverts, bridge channels, and ditches must be kept clear to provide melted snow drainage.

Ice Routes

- In some areas, the best sites for winter road routes will be found along frozen waterways. Such sites are relatively easy to prepare, requiring only snow removal and possible thickening of the ice in places by adding water to accelerate the ice growth. However, disadvantages are many. A sudden rise in temperature can make the route unusable, convoy speed is limited, and recovery operation of vehicles which break through the ice may force traffic to seek alternate routes. Because of these disadvantages, tactical plans should not be based solely on ice routes and bridges unless there are no other alternative solutions.

- Road routes over and across lakes and streams are selected only after detailed reconnaissance of ice conditions, to determine the ability of the ice to support the heaviest load which it must bear. The entire route over ice must be checked, as the consistency and/or thickness of ice can vary over a relatively short distance. As traffic passes, the ice routes must be periodically

monitored to detect possible degradation. A snow cover or a warm current will affect the ice temperature and generally will produce a thinner and weaker ice cover.

- If the conditions are favorable, an ice bridge may be easily constructed. This requires some means of flooding the ice and freezing temperatures, preferably below 10 degrees Fahrenheit. If the temperature is above 25 degrees Fahrenheit, floodings should be done in the evening to take advantage of the cooler night temperatures. A site should be located which, within the tactical limitations, provides the best combination of shortest distances, gradual sloping embankments, and low water turbulence. The natural ice should be at least 10 centimeters (4 inches) thick at the site

selected to support men and equipment required to construct the bridge.

Air Landing Facilities

- With little effort, hard, wind-packed areas can generally be made usable for aircraft equipped with skis by smoothing the surface with a drag. Deep soft snow, however, presents difficulties in the landing and takeoff of aircraft, even when they are equipped with skis. For fixed-wing aircraft, the deeper a ski sinks into the snow, the longer will be the ground run required for takeoff. Likewise, skis on utility helicopters may not provide sufficient flotation in deep powder snow, allowing the helicopter to settle deep enough to cause the tail rotor to strike the snow.

Load Bearing Capacity for Fresh Water Ice

Load	Ice Measurements for Temperatures 0-10°F				Distance Between Units	
	Risk		Normal		Meters	Yards
	CM	In	CM	In		
Single soldier on skis	4	1½	5	2	5	6
File of soldiers — 2 meter interval	8	3	10	4		
Vehicles:						
¼-Ton Truck	13	5	20	8	15	16½
1¼-Ton Truck	25	10	32	13	25	27
2½-Ton Truck	33	13	40	15½	25	27
5-Ton Truck	45	17½	55	21½	60	65½
5-Ton Tractor w/loaded Trailer	80	31½	90	35½	80	87½
M60 Tank	47	26½	80	31½	70	76½
M88 Recovery Vehicle	71	28	85	33½	70	76½
M100 How, SP, 155mm	50	20	55	22	50	54½
M107 Gun, SP, 175mm	45	17½	50	20	40	43½
M110 How, SP, 8"	50	20	55	22	50	54½
M113 APC	33	13	45	17½	25	27
M548 Cargo Carrier	33	13	45	17½	25	27
M577 Carrier CP	33	13	45	17½	25	27
Tractor D7	45	17½	50	20	40	43½
Tractor D8	50	20	60	23½	50	54½
Crane 20 Ton	50	20	60	23½	70	76½
Grader	35	14	40	15½	50	54½
Aircraft						
U-8D, F	17	6½	25	10	20	22
U-21A	21	6½	27	10½	20	22
AH-1G	20	8	25	10	20	22
UH-1A, B, D	20	8	25	10	20	22
CH-47A	39	15½	50	20	60	65½
CH-54A	45	17½	50	20	60	65½

*Measurements shown in inches and yards have been rounded off to the nearest one-half.

†Risk ice measurements can be used for individual crossings with safety. The normal ice measurements are for repeated loadings.

NOTE: Vehicle should maintain speeds of approximately 10 mph. Parking distance between aircraft has been computed based on maximum allowable gross weight and may be adjusted based on loads carried in individual aircraft.

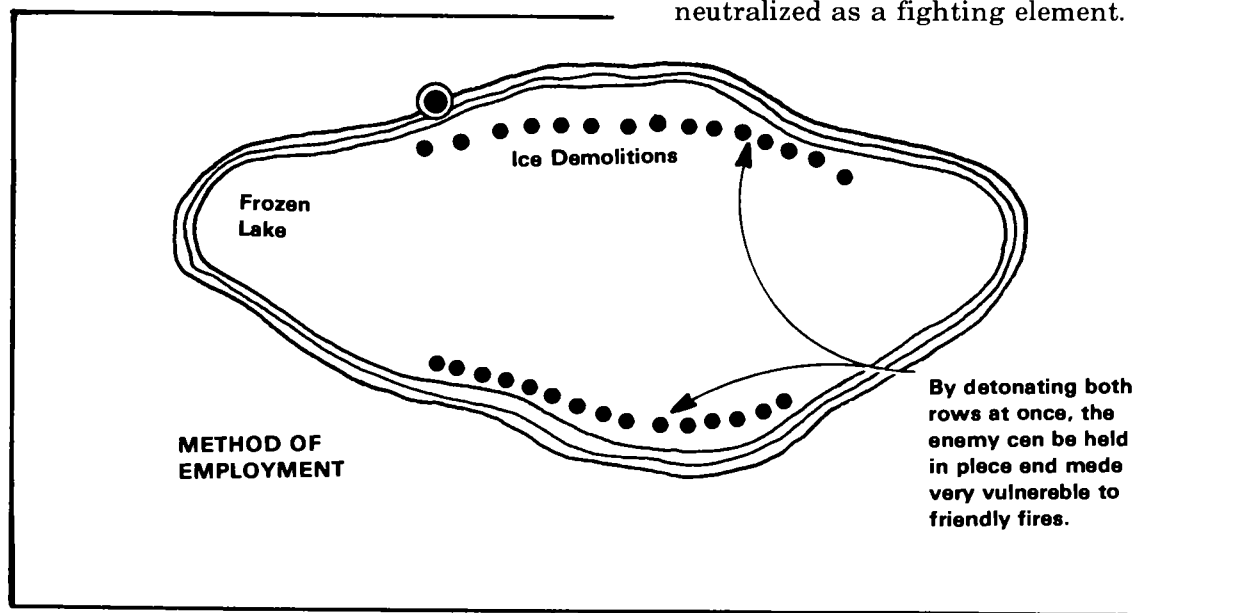
COUNTERMOBILITY

Wire

Wire obstacles are practical, but they tend to lose their effectiveness as depth of snow increases. When constructing wire barriers, iron pickets are better than wooden pickets in frozen ground. Shaped charges, power drills, steam jets, or heated iron rods can be used to sink holes. Wire can easily be set at the necessary height in woods and forests by attaching it to trees. The wire should be placed close to the ground to prevent the enemy from tunneling underneath the obstacle. If time is lacking or there is uncertainty as to the amount of snowfall, long pickets can be used; the upper strands of wire can be added later as the snow accumulates. Concertinas are the best wire obstacles for use in deep snow; however, they must be moved or replaced before hard packed snow covers them.

Explosives

In summer, the thousands of lakes, rivers, and swamps of the northern regions provide formidable obstacles to armor and personnel. In winter, however, when frozen to sufficient depth, they provide excellent avenues of approach and lengthen the frontline of a given sector, thus requiring more troops and weapons to defend them. A frozen body of water may be temporarily turned into an effective obstacle by using explosives to break the ice. In blasting, the explosive must be placed under the ice to effectively produce craters. Normally, one or more sets of charges are laid close to the friendly shore and others are placed farther out in the direction of the enemy. The enemy may be allowed to advance past the first set of charges, at which time both sets are detonated simultaneously. The enemy thus will be marooned on an ice flow, unable to continue to advance or retreat, and can be neutralized as a fighting element.



Mines

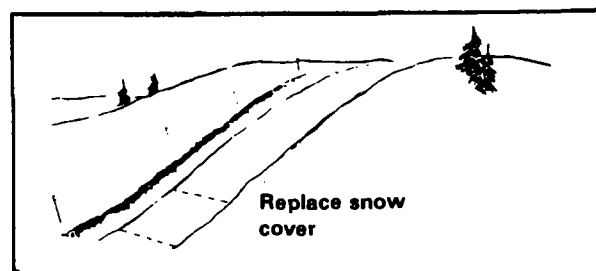
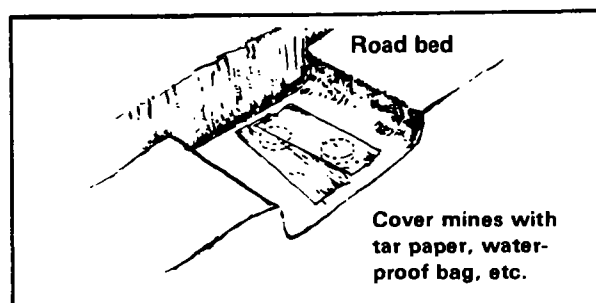
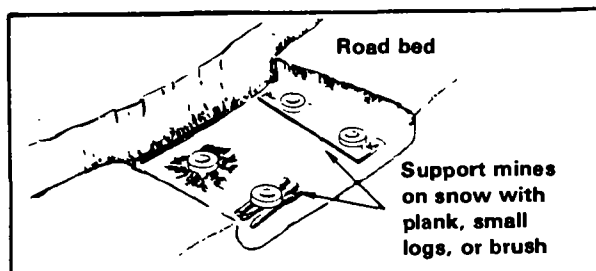
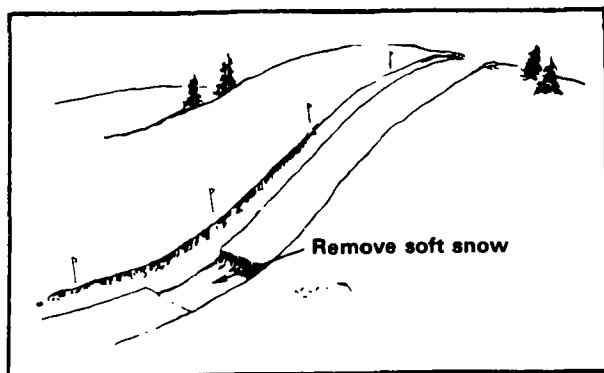
For use in snow, mines should be white and the tracing tapes colored. Arming of mines in quantity is a difficult task in low temperatures.

- Antipersonnel mines, activated by pull- or pressure-type fuzes, are effective on ski trails. When a pressure-type firing device is used, the mine must be placed about 2 centimeters (1 inch) under the snow surface

because the weight of an individual is distributed over the length of the ski. To insure activation, pressure-type antipersonnel mines should be placed on firm bearing surfaces such as boards or large rocks.

- Antitank mines are not always effective under heavy snow cover. The mines may be placed on the ground where the snow has been removed, or they may be placed near the surface of the snow on a firm bearing surface.

A thaw or concentrated traffic often renews the effectiveness of a snow-covered mine. However, the mine may fail to detonate if the water has entered it and become frozen. Minefields should be inspected periodically, and necessary maintenance performed.



SURVIVABILITY

Field Fortifications

- Excavation by hand is difficult, if not impossible, in frozen ground. Explosives are

effective but large quantities are required. Normal charge calculations cannot be made because of variations in moisture content, soil types, and vegetation as well as property changes resulting from low temperatures. Consequently, demolitions must be computed on experience and test shots.

- Hastily made fighting positions and trenches can be built in the snow and reinforced with snow and timber. Sandbags filled with sand or snow are effective for speedy construction of defensive positions on frozen ground. Water poured on the bags freezes and improves their protective qualities for the duration of the cold weather. Large (100-pound) empty feed sacks are excellent field expedients for this purpose. It is approximately 10 times faster to build aboveground snow positions than to dig unfrozen ground to obtain the same degree of protection.

Camouflage and Deception

- In winter the whiteness of the countryside emphasizes any item which does not blend in naturally with surroundings. Furthermore, every movement by vehicles or dismounted troops leaves tracks in the snow. In extreme cold, heat sources (engine exhausts, warm water effluents) produce fogs that readily compromise concealment.

- In the northern landscape, backgrounds are not necessarily all white. General observation of snow-covered terrain in wooded regions reveals a surprising proportion of dark areas with rocks, scrub bushes, and shadows making sharp contrast with the snow. Locations for emplacements and vehicles must be chosen to take advantage of existing dark patterns to absorb shadows cast by friendly forces or their equipment. Snow should be used to conceal trenches and foxholes. The slope of the snow should be gentle, with all sharp angles hidden. Vehicle crews must be trained, upon halting, to pile snow around tracks and wheels in order to break up the regular patterns of their vehicles.

- Many opportunities for unit or individual deception exist in the north during winter. Unless unit and individual

camouflage is effective, however, the value of any deception plan will be greatly reduced. Dummy weapons, positions, tents, and vehicles of all kinds can be constructed from snow, branches, and canvas. A dummy bivouac area must appear to be occupied.

Small gasoline or oil flames may be used to simulate stoves or idling engines. A few skiers or over-snow vehicles can create a network of trails or tracks to mislead the enemy as to direction, strength, location, and intentions.

SNOW BREASTWORK CONSTRUCTION FOR PROTECTION FROM SMALL ARMS FIRE

Snow Density (lb/ft ³)	Round	Muzzle Velocity (ft/sec)	Penetration (ft)	Required Minimum Thickness (ft)
11.2 - 13.	5.56mm	3,250	3.8	4.4
17.4 - 23.7	5.56mm	3,250	2.3	2.6
11.2 - 13.1	7.62mm	2,750	13.0	15.0
17.4 - 23.7	7.62mm	2,750	5.2	6.0
25.5 - 28.7	7.62mm	2,750	5.0	5.8
19.9 - 24.9	.50 cal	2,910	6.4	7.4

NOTES:

- (1) These materials degrade under sustained fire. Figures given are for sustained fire (30 rounds into a 1 ft x 1 ft area).
- (2) Penetration characteristics of Warsaw Pact ammunitions do not differ significantly from those cited for US counterparts above.

GENERAL ENGINEERING

Water Supply

- The main problem of supplying water in the north is in providing large enough quantities for the water purification unit. Melting snow and ice in sufficient quantities to provide water may be satisfactory for emergency use of individuals. It is impractical, however, to meet all needs of large units because of the large amount of fuel needed to obtain a small amount of water. Seventeen cubic inches of loose snow, when melted, yield only 1 cubic inch of water. (A gallon container full of loose snow will yield somewhat less than one-half pint of water when melted.) The chief sources of water supply for large units, in the order of their efficiency and economy, are: drawing water from under river or lake ice, melting ice, melting snow, and well drilling (semipermanent and permanent camps). Ice or snow melted for drinking water must be decontaminated if the area has been exposed to nuclear, biological, chemical (NBC) warfare. Water supply operations in tundra areas will be further complicated because

lakes are usually very shallow, often frozen solid, and may be difficult to locate due to the slight terrain relief of tundra regions. During the winter, a river source should provide better quality water than a shallow lake. In summer, however, when streams and rivers are turbid, the reverse would be true.

- Water points on lakes and rivers should be located on the leeward side where there is generally clearer water, less snowdrifting, and more shelter from the wind. Lake sites should be located away from the shore within effective camouflage limitations. Shaped charges are far superior to handtools in making holes in thick ice. Handtools are generally ineffective in ice over 60 centimeters (24 inches) thick. Ice usually will be thinnest where it is covered by the snow. When pumping water through the ice, the hole can be kept clear by placing the suction strainer no deeper than about a foot below the surface.

- All field water distribution units should be insulated or equipped with some form of heating device to keep the water in liquid state. Water containers should be filled only

three-quarters full to allow agitation of the water during transit. Metal water cans are preferable since they may be heated if their contents freeze.

Engineer Materials

The supply of engineer materials is affected by transportation difficulties. Local resources of sand and gravel are difficult to locate under snow and ice and hard to excavate when frozen. Standing timber is rare or nonexistent in tundra regions, but may exist in other northern areas.

GENERAL

Deserts are extensive, arid, treeless expanses, characterized by an almost total lack of rainfall, and extreme daily temperature fluctuations. The terrain consists of sand, boulder-strewn areas, mountains, dunes, deeply eroded valleys, rock and shale, and salt marshes. Formidable natural barriers are often present in the form of rock escarpments. All military operations in desert areas are influenced by lack of water, few well-defined roads, the absence of natural cover and concealment, and the difficulty of land navigation. Engineer operations are seriously affected.

Section II DESERT OPERATIONS

MOBILITY

- Roads and bridges do not call for special techniques in desert operations. The necessary dust palliatives and soil stabilization materials are usually too scarce to use except for the most important facilities, (e.g., airfields). Although drainage is not a major consideration, flash floods are possible in desert areas and should be considered in road and bridge construction.

- In most desert areas, the sandy, level ground surfaces offer a good selection of sites for aircraft landing fields. Landing strips, heliports, and aircraft hardstands can be improved by the use of membrane or landing mat. Dust control on runways, taxiways, and adjoining areas is a major consideration.

COUNTERMOBILITY

The comparatively small number of troops in an area, the limited number of natural

obstacles, and the extended area of operations often dictate the employment of mines. Not only are mines easily placed in the desert, but blowing sand effectively conceals evidence of their emplacement. However, sand may adversely affect their proper functioning. Small minefields are of little use since they are easily bypassed. Extensive minefields may be used to canalize enemy movements into areas where other natural obstacles may then prove effective. Major mine operations are directed toward key terrain features, manmade facilities, and natural resources critical to the enemy. Once in place, they are covered by observation and fire.

SURVIVABILITY

Field Fortifications

- Field fortifications should be built at or below ground level to prevent the enemy from recognizing the position. In constructing firing positions for weapons with high silhouettes, these positions should be located on reverse slopes and situated to fire obliquely. The weapons could also be held in hidden positions and brought forward to fire as required.

- It is extremely difficult to prepare field fortifications in the desert where there is a hard-surfaced layer of so-called "surface chalk." Under this surface layer, the ground is soft and, therefore, easier to work. In the construction of field fortifications, it is first necessary to blast away the surface chalk layer. Work of this kind can be done only if sufficient time is available. If a hasty defensive system is being established, stones and rocks may be piled to form emplacements.

- Foxholes and positions can be dug easily in sand and in the loose loam or clay of depressions. Because of the absence of timber, revetment work may present difficulties. Materials that can be used to revet vertical surfaces are sandbags, earth-filled ammunition boxes and large shell cases.

- Vehicles should be placed in defilade position to reduce their silhouettes and provide cover from artillery fire.

Camouflage and Deception

- The lack of natural overhead cover, the increased range of vision, and the bright tones of the desert terrain require emphasis on camouflage and deception. Emphasis must be placed on siting, dispersion, track discipline, and the skilled employment of dummies and decoys. Shadows cast against the bright background show conspicuous contrasts. Total concealment is rarely achieved, yet proper camouflage measures can reduce the effectiveness of enemy observation.

- Siting or selection of position is of critical importance in desert operations. One of the basic principles of camouflage is to fit or blend into the existing ground pattern with a minimum amount of change to the original terrain. Since shadows locate and identify objects, all vehicles must be parked to cast the smallest possible shadow. The best results can be obtained by having the shadow fall on low vegetation or rough ground. All positioned vehicles and weapons should be equipped with camouflage screens.

- Lack of concealment increases the need for dispersion in desert areas. Individuals and units should disperse to the maximum extent consistent with the need for security, control, and mutual support. Numerous converging vehicle tracks can reveal the location of important installations or command posts. To avoid this, vehicles should follow designated routes when they approach these areas. Personnel are discharged 300 to 400 meters from the installation and walk the remaining distance.

- The erection of empty camouflage screens is an effective deceptive measure. Use of empty screens can mislead the enemy as to size, type, and intention of opposing forces. Realism can be obtained by overnight changes of "vehicle" locations and the variation of tracks by a few real tanks.

GENERAL ENGINEERING

Water Supply

- Finding and exploiting water sources is an important mission of the engineers supporting a desert operation. The discovery of water sources requires continuous and intensive reconnaissance. Oases are ordinarily separated by great distances. In some areas, water may be obtained from deep wells or by drilling into the beds of dry watercourses. With special apparatus for distillation, the water from salt or alkaline ponds and marshes may be made potable.

- Because troops are widely dispersed in desert operations and water points are few, water must be transported over long distances. Sometimes pipelines are laid;

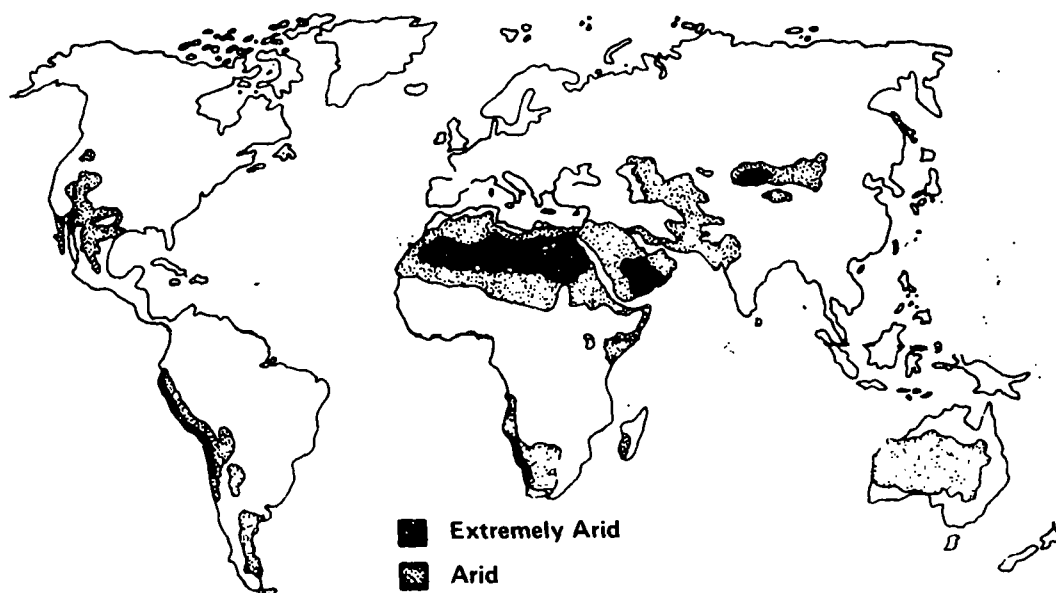
however, in fast-moving situations the hauling of water is the most practical method. This requires close coordination between engineers and the transportation units responsible for the movement of bulk water.

- In retrograde movements, the destruction of water sources and stocks of water is vital. Wells and pipelines are destroyed and stocks of water released. The extent of destruction, as in all denial action, is governed by higher directives.

Petroleum, Oils, and Lubricants

Engineers may be required to support minor construction of berms for the collapsible tanks and the pumping stations.

DESERT AREAS



Section III

JUNGLE OPERATIONS

GENERAL

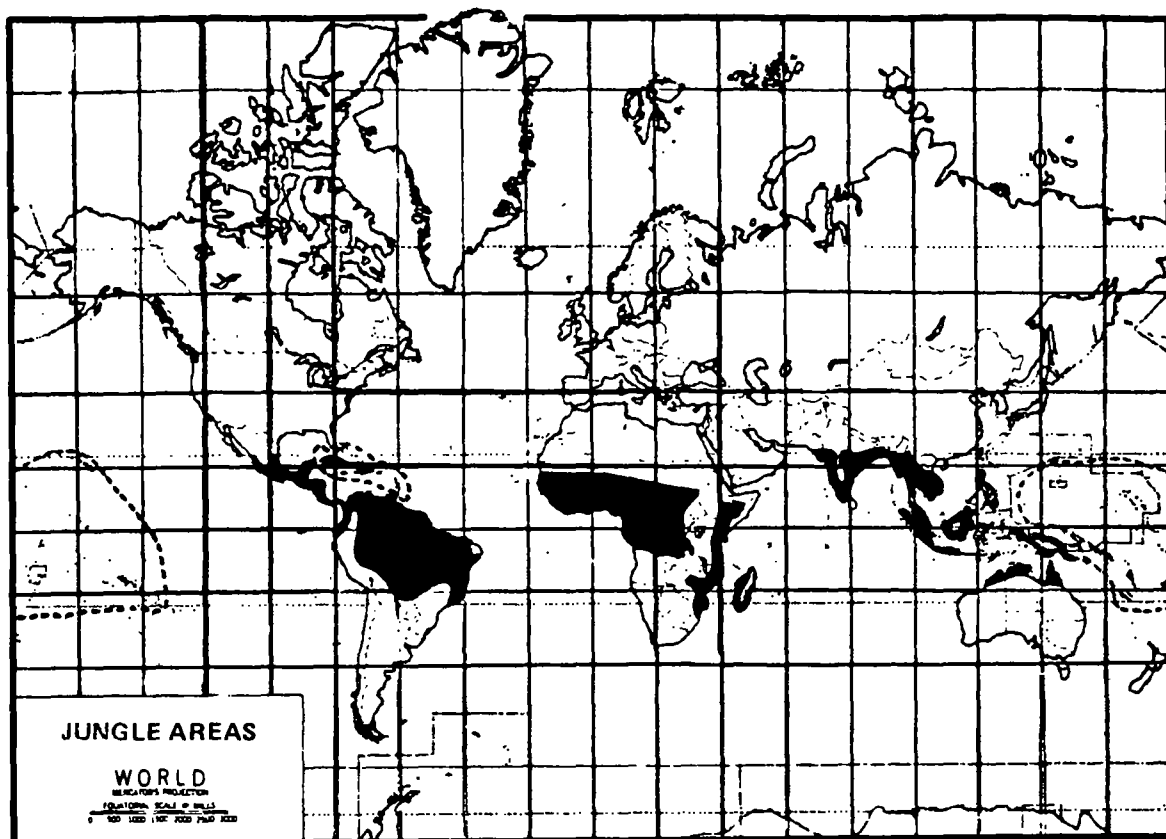
With the tropical zone, diverse environmental conditions exist. This section is concerned with only that part of the tropics where the temperature and relative humidity remain high throughout the year. Jungle is defined as that area within the humid tropics where the growth of trees or other types of associated vegetation is dense. It impedes military operations and tends to obstruct military lines of communication. Tropical vegetation in jungle areas includes lowland and highland tropical rain forest, dry deciduous forest, secondary growth forest, swamp forest, and tropical savannas. Movement of troops and supplies through jungle growth is most difficult. Visibility is often limited to a few feet. Jungles are sparsely inhabited. Good roads are rare to nonexistent, usually narrow and winding, and incapable of supporting sustained military traffic. Air support thus becomes more important. Major tasks performed by engineers are the construction and maintenance of roads and trails and the construction of airfields, landing zones, and supporting facilities.

MOBILITY

Road Construction

- The construction and maintenance of roads are the greatest concerns of engineers in jungle warfare. Generally, every road to be used must be newly built. There are numerous factors that complicate road construction in the jungle.

- The heavy rainfall imposes a drainage problem of major concern. Ground water is frequently found within a few inches of the surface, requiring special attention to subgrade drainage. Whenever possible, low ground should be avoided in laying out a road. When it is impossible to bypass low swamp ground, it may be necessary to construct pontoon bridges or long sections of corduroy road. It is advisable to cut the right of way much wider than normal so the sun can dry out the roadbed. The enlarged right of way also provides room for the construction of the large ditches necessary to keep the subgrade drained.



- Frequently, the soil is composed of decayed vegetation which must be removed and replaced with some suitable material.

- Bridge design along roads should consider the intense rainfall and consequent flooding. For small bridges, it may sometimes be advisable to allow for normal flow only and to be prepared to replace the bridges promptly if washed out. Helicopters can be used to transport standard bridge components or bridge timbers to sites requiring bridging or bridge repair.

Bank conditions will often be the major obstacle in jungle river crossings.

Air Landing Facilities

Engineer units are required to construct helipads and airstrips in remote areas of the jungle in support of tactical operations. Engineer work crews, equipped with chain

saws and demolitions, are airlifted by helicopter to the remote jungle area and may have to rappel into the site. These crews make the initial clearance of trees and underbush. Follow-on engineers, equipped with sectionalized airmobile engineer equipment, are airlifted to the jungle clearing with their equipment and expand the landing zone or airstrip in accordance with the tactical plan.

COUNTERMOBILITY

Since the jungle itself is an obstacle, the clearing of even simple trails may be critical to tactical mobility.

- Major impediments to jungle movement include dense vegetation, deep eroded gullies, steep hills and cliffs, wide and deep rivers, and numerous fast-flowing unfordable streams which can become raging torrents. During the rainy season, swamps may become impassable even to foot movement

because of the depth of the water.

- As the jungle itself is an effective obstacle against vehicles, antitank mines and other antivehicular obstacles are normally confined to roads, trails, and occasional patches of cleared ground.

SURVIVABILITY

Jungle areas provide excellent concealment from air and ground observation. By employing proper camouflage techniques, it is possible to conceal troops and ground observation in all types of jungle vegetation except in the very young secondary growth. Therefore, *unnecessary* clearing of overhead concealment must be avoided when making movements and when occupying positions. However, the concealment provided by vegetation offers no protection from enemy fire except in tropical rain forests. Because of the high annual rainfall and the resultant erosion, excellent cover in jungle areas is provided by surface irregularities, such as ravines, gullies, and large rocks. In certain jungle areas, high water tables require that manmade cover be constructed above ground level.

GENERAL ENGINEERING

Water Supply

Water supply is rarely a serious problem. In many areas a water source may be created by merely excavating a pit below the ground water table. Where the topsoil is underlined with coral, potable water is often found on the coast, as close to the shoreline as 50 feet. However, all water used for drinking must be treated because of the many diseases which may be transmitted by impure water. Personnel working in raw water must be given special protection because of the danger of contracting serious diseases caused by waterborne organisms and parasites peculiar to the topics.

Reconnaissance

Jungle areas present special reconnaissance problems. Roads, railroad tracks, and trails are critical since they present the only means of traversing the jungle. Aerial

reconnaissance is limited by the inability to penetrate the tree canopy.

- Because of the inaccessibility of jungle areas, standard maps may be scarce and those that are available frequently are inaccurate. The numerous minor swamps, streams, inlets and lagoons are seldom indicated and contours, if shown, are seldom precisely accurate. Trail nets that are shown usually can be depended on, because traditional routes are rarely altered in the jungle.

Engineer reconnaissance to supplement map data is of prime importance.

GENERAL

Mountains are generally defined as landforms higher than 500 or 600 meters characterized by steep slopes. Slopes are commonly 4 to 30 degrees and, in cliffs and precipices, may even be vertical or overhanging. Mountains may consist of an isolated peak, single ridges, or complex ranges extending for 1,000 kilometers or more.

Military operations in mountainous terrain involve relatively small forces with independent missions, as the difficulty of movement makes close mutual support impossible. The problems that befall the engineers are greatly multiplied and, for this reason, the proportion of engineers to the size of the force is greater than in other operations. Large quantities of heavy equipment ordinarily cannot be employed. Consequently, there is greater emphasis on work with handtools and light, powered equipment. Most mountain operations are directed toward opening, securing, or denying the use of passes and other key points on the lines of communication.

MOBILITY

Road Construction

- Construction of new roads in mountains is an engineering task of major proportions because of the amount of rock excavation required. Ordinarily, road work is limited initially to the maintenance and repair of

Section IV MOUNTAIN OPERATIONS

existing roads and trails with plans for their subsequent progressive improvement.

- Routes are selected with regard to the speed with which the roads can be put into service. Abnormal gradients on roads may be required initially to insure that construction will maintain pace with tactical operations. Sidehill cuts are the rule, and the same contour line is followed to avoid excessive fills or bridging. Turnouts should be installed every one-half kilometer to reduce traffic congestion on single-lane roads or trails.

- Drainage should receive increased emphasis due to abnormal slopes, damaging thaws, and heavy rains. Roadbeds on a hillside should be banked to the inside to eliminate cross-road drainage structures and to prevent loss of equipment over a bank as a result of skidding. Culverts must be of ample capacity to take the high flows during spring thaws. If the road is to be used during the winter, plans for its location and alinement should include consideration for minimizing snowdrifting and avalanches.

Bridging

- Bridging operations in mountainous terrain normally are limited to the spanning of short gaps using prefabricated materials. Standard design or improvised suspension bridges may be employed for longer spans. Cableways and tramways which can be obtained in kits are frequently used to move light loads and personnel over gorges and up steep slopes.

COUNTERMOBILITY

Obstacles are particularly effective in mountainous terrain, since it is very difficult

to bypass them. Properly placed and covered by fire, they can often make the approaches to a position or to other commanding ground almost impassable. In mountainous terrain, hasty protective mining techniques are utilized more frequently than patterned mining techniques.

SURVIVABILITY

Irregular mountain terrain provides numerous favorable places for concealment and cover. Digging of foxholes and temporary fortifications is generally difficult because soils are thin with underlying bedrock. Boulders and other loose rocks are available and can be used for construction of hasty fortifications.

GENERAL ENGINEERING

Reconnaissance

Because rugged mountain terrain makes field reconnaissance time-consuming and dangerous, aerial reconnaissance is emphasized.

Terrain Analysis

Terrain analysis for routes, trafficability, and availability of local materials is of special importance in mountain warfare. Engineer terrain intelligence teams given reconnaissance information and aerial photography can quickly provide detailed information which is unavailable from any other source. Relationships between vegetation and soil conditions, developed through terrain evaluation, aid the engineer in his determination of trafficability and sources of materials.

Appendix H
NUCLEAR,
BIOLOGICAL,
AND CHEMICAL
ENVIRONMENT

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GENERAL

The primary reason for NBC weapons is the same as for any other weapon.

- Produce casualties
- Destroy or disable equipment
- Gain a tactical advantage

NBC weapons may be employed separately or in combination and, when used, normally supplement conventional weapons. On today's battlefield, this use of NBC weapons is a possibility. Our forces must be prepared to operate in this environment from the outbreak of hostilities, even though NBC weapon use may not occur until later in the hostilities.

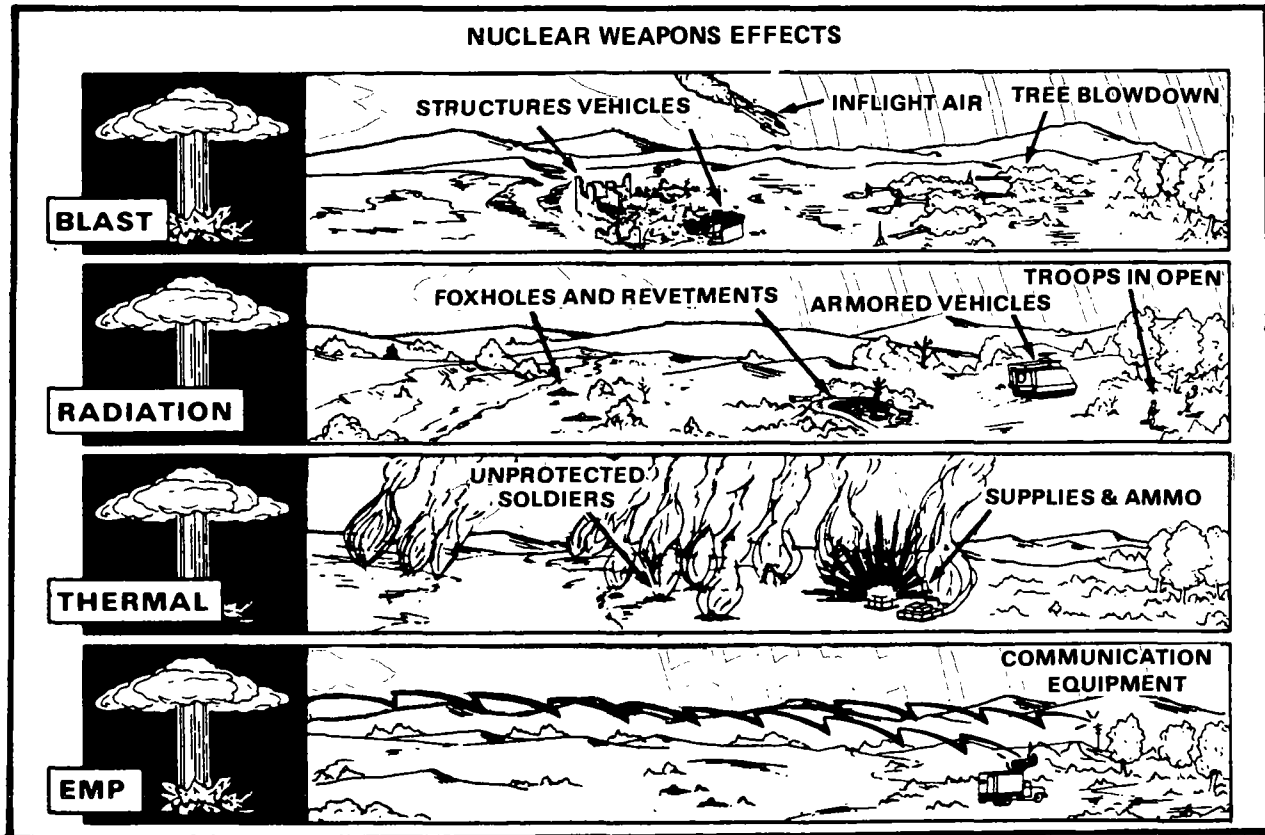
OPERATIONS IN A NUCLEAR ENVIRONMENT

Nuclear weapon effects consist of the following:

- Blast
- Thermal radiation

- Electromagnetic pulse
- Residual radiation

Nuclear detonation effects present new phenomenon and increased destruction on the battlefield when compared with conventional weapon effects. Blast effect is vastly increased and can produce casualties both through static overpressure and the high winds associated with a blast wave. Intense heat from thermal radiation is a danger to unprotected troops and secondary fire can greatly hamper operations. For smaller yield tactical weapons, nuclear radiation has the most significant effect on troops whether they are in the open, in armored vehicles, or in foxholes. The electromagnetic pulse (EMP) which emanates from a nuclear burst can damage radios and other electronic equipment, seriously hampering command and control communications. Residual radiation in the form of fallout or induced radiation at the burst site can also produce casualties, restrict movement, and deny terrain long after the initial effects have dissipated.



PROTECTIVE MEASURES (NUCLEAR)

General

The more each soldier knows about nuclear weapons capabilities, the more effective he will be on the nuclear battlefield and the greater will be his chances for survival. Training must stress the interrelated importance of discipline, camouflage, cover, concealment, dispersion, and immediate reaction to increase a unit's chance of survival on the battlefield.

- A tank or CEV provides protection roughly equivalent to that provided by a 4-foot-deep foxhole with overhead cover. Tank crews may have to operate on the nuclear battlefield with the hatches closed.

- The APC provides protection against nuclear radiation generally the same as that of the tank, but to a lesser degree.

- For dismounted personnel, a deep foxhole (covered or uncovered), ditch, culvert, or even a slight depression in the ground will provide protection from the initial effects of a nuclear detonation.

Although the nuclear weapon is a tremendously destructive military device, there are defensive measures which can effectively be taken against its effects. In areas of fallout, increasing the amount of shielding through use of heavier vehicles or sandbagging vehicles' floors will provide increased protection. Also delaying entry into a fallout area as long as possible and limiting the time of stay will reduce the amount of radiation received. For dismounted personnel, deep, covered foxholes or deeply buried culverts are the best protection against fallout.

Detection

Hazard from residual radiation may last for many days and cover many square miles. Since nuclear radiation cannot be detected by the physical senses, radiac instruments are provided engineer units to measure radiation. These instruments measure both the total dose received by personnel and the dose rate in the area. When operating on the

nuclear battlefield, radiological monitoring is included in all reconnaissance and intelligence activities on the battlefield according to procedures established by higher levels of command.

Minimizing Exposure

After residual radiation has been detected by radiological monitoring, the engineer unit continues its mission, and, if possible, relocates to minimize radiation exposure. If it is necessary to remain in the fallout area, armored vehicles button up completely with the crew remaining inside. Dismounted personnel occupy shelters with overhead cover. The amount of time a unit may stay in a contaminated area depends on the intensity of radiation and the amount of protection available. Time spent in the open away from shelter must be minimized.

Decontamination

Once fallout has stopped, radioactive dust on top of shelters and vehicles must be brushed away. This serves as emergency decontamination; however, complete decontamination must be accomplished as soon as possible.

OPERATIONS IN A CHEMICAL OR BIOLOGICAL ENVIRONMENT

General

It is the policy of the United States not to use toxic (lethal) chemical weapons first. They may be used if an enemy employs them first against the United States. The US will not use biological weapons under any circumstances. Threat forces have both chemical and biological weapons and are prepared to employ them. These weapons may be used separately, together, or in conjunction with nuclear weapons. Engineer units must be prepared to conduct operations in an active chemical and biological environment.

Characteristics of Chemical and Biological Agents

Lethal chemical agents are similar to poisonous compounds used in everyday life to kill flies, mosquitos, and other insects, but are far more powerful, and are released to cover relatively large areas. They may be

placed on a target as a gas, as finely divided liquid or solid particles (aerosols), or as liquid droplets. A mixture of agents can be used to cause confusion and increase casualties. They can be disseminated by artillery, mortars, rockets, missiles, aircraft spray, bombs, and landmines. They may be odorless and colorless. Biological agents are disease-producing micro-organisms (germs). The intentional use of micro-organisms creates a disease hazard where none exists naturally. These agents may be dispersed as aerosols by generators, explosives, bomblets, missiles, and aircraft. Harmful micro-organisms may also be spread by the release of living insects, such as flies, mosquitos, fleas and ticks.

Effects on Personnel

Chemical and biological agents may enter the body through the eyes, nose, mouth, or skin. They can produce incapacitation or death.

Liquid agents may be dispersed on equipment, terrain, and foliage. The agent may remain for hours or days, presenting a serious hazard to unprotected personnel.

Effects on Food and Water

Liquid chemical agents will have little effect on rations that are packaged. Rations that are directly exposed to contamination should be disposed of so that they are not inadvertently consumed. Packaged rations are easily decontaminated by personnel familiar with decontamination procedures. Medical personnel must inspect and approve the food before it is eaten.

Purification of contaminated water requires the use of chemicals and equipment not found in standard water purification sets. Use of uncontaminated water supplies and transportation of this water is the most satisfactory solution. Water in closed containers is safe for drinking after decontamination of the outside of the container.

Effects on Equipment

Chemical and biological agents have little direct effect on equipment. Liquid chemical

agent contamination on equipment can cause casualties or restrict its use until appropriate decontamination is accomplished.

Emergency decontamination of vehicles and equipment is accomplished by crew members.

Effects on Terrain

Liquid chemical agents may restrict use of terrain and buildings. Decontamination of large areas of terrain is extremely difficult. However, because of equipment and special skills, engineer units may be assigned limited decontamination missions, such as decontaminating an airfield or clearing a route through a contaminated area. Hard surfaced roads or airfields can be decontaminated by spraying the surface with a standard decontaminate, using the power-driven decontamination apparatus available in certain engineer units. But roads or airfields can be decontaminated by scraping away the top level of dirt or covering the area with at least 10 centimeters of uncontaminated soil. Normally, contaminated areas will be bypassed. Contaminated areas may be crossed when individual protective equipment is worn.

After a mission in a contaminated area the soldier, his personal equipment, and unit equipment must be decontaminated.

Detection

Chemical agents can be detected by using a chemical agent detector kit, and automatic chemical agent alarm, detection paper, or detection crayon (see FM 21-40). Operators for unit chemical detection equipment must be assigned and trained.

Biological agents are extremely difficult to detect during early stages of use. Information on enemy biological agent use is normally disseminated by higher headquarters. Soldiers should be alert to any indication that biological agents have been used. Unusual occurrence of disease must be promptly reported through the chain of command.

PROTECTIVE MEASURES (CHEMICAL OR BIOLOGICAL)

Engineer units must train to apply protective measures against toxic chemical and biological attack. Standing operating procedures must provide for a warning system; use of individual and unit protective equipment; prompt decontamination of individuals, equipment, and supplies; and prompt treatment of casualties.

A soldier's primary protection against TOXIC CHEMICAL AND BIOLOGICAL attack is his protective MASK.

To be protective against *LIQUID CHEMICAL AGENTS*, soldiers must wear chemical *PROTECTIVE CLOTHING* as well as *MASKS* — complete individual protective overgarments, protective boots, and protective gloves.

A unit conducting operations while wearing protective clothing will experience a loss of operational effectiveness due to heat stress, psychological stress and reduced mobility, visual acuity, and manual dexterity. This degradation of effectiveness will vary with many factors — level of training, physical conditioning, level of protections, and morale. To minimize degradation, a unit should train and condition in NBC protective operations so that personnel are confident they can perform their combat tasks while wearing complete protective uniforms.

A flexible system of protection to facilitate mission accomplishment is the Mission Oriented Protective Posture (MOPP). It specifies the wear of individual protective clothing and equipment consistent with the chemical threat, the work rate imposed by the mission, the temperature, and the humidity. MOPP does not mean personnel must wear

all their protective clothing and equipment all the time. In fact, because of mission requirements, body heat buildup, and basic human needs, not all equipment can be worn for an indefinite period. The commander is able to prescribe a level of protection that strikes a balance between the need for chemical protection and the work rate required for mission accomplishment.

Chemical protective clothing and equipment provide protection from biological attack also. There are two additional aspects of biological defense with which the task force commander must be continuously concerned. The first is an aggressively enforced immunization program. Such a program provides immunity to a wide variety of potential biological warfare agents but, to be effective, must be enforced prior to an attack. The second aspect is a rigorous adherence to good field sanitation practices. This type of program is effective both before and after attack in reducing losses due to disease.

ENGINEER OPERATION IN THE NBC ENVIRONMENT

Normal engineer tasks and functions will not change during NBC operations. However, performance of these tasks will be complicated by the massive destruction and larger areas of contamination associated with NBC operations. After a nuclear detonation, additional engineer effort might be required to clear debris, search for casualties, or extinguish fires. When performing engineer tasks in areas of chemical contamination, the work rate degradation effect caused by the wear of protective clothing and equipment must be considered. A reasonable estimate of work rate degradation can be established through training experience while operating in protective equipment.



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Appendix I

STRONGPOINT

This appendix will give the engineer insights into the mission of teaming with the maneuver units to develop a **STRONGPOINT**. A strongpoint is the cork in a bottleneck formed by terrain, obstacles, and units and is a countermobility tactic on the mobile battlefield. The engineer assists in the construction of strongpoints by using the "Building Block" approach.

DEFINITION

A strongpoint is a battle position which is fortified as strongly as possible within the time constraints to withstand direct assaults from armor and dismounted infantry. It is located on key terrain which is critical to the defense, and it controls an avenue of approach likely to be used by enemy mechanized forces.

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ORGANIZATION OF STRONGPOINT

In some cases, the brigade or division commander may direct that a strongpoint be emplaced by a battalion or company-sized unit. There are several important aspects about a strongpoint that need to be clearly understood.

The strongpoint is essentially an antitank "nest" which physically cannot be overrun or bypassed by tanks, and which can be reduced by enemy infantry only with the expenditure of much time and overwhelming forces. It is the cork in a bottleneck formed by terrain, obstacles, and units. It is similar to a perimeter defense in that it is developed to defeat an attack from any direction. It is distinguished from other defensive positions by the importance of the terrain on which it is located. It is also distinguished by the time, effort, and resources dedicated to its development.

A strongpoint is not routinely established. It is established only after the commander determines that a strongpoint is absolutely necessary to prevent decisive penetration of his defensive system by enemy armor. The decision to do so must be carefully weighed.

- The force that establishes the strongpoint may become isolated or lost.
- The force that establishes the strongpoint loses its freedom to maneuver outside the strongpoint.

Assignment of this mission presupposes:

- The existence of terrain that lends itself to the mission.
- The availability of maneuver units and fire support assets required to defend the strongpoint.
- The availability of sufficient engineer assets to assist in the preparation of the strongpoint.
- Time, supplies, and equipment necessary to effect minimal preparation.
- A threat whose advance will be physically impeded by the position.

Because considerable time is required to develop a strongpoint, the battalion must be emplaced far enough from the line of contact to provide the necessary time. Terrain to the flanks must restrict the advance of the mounted attacker.

The maneuver commander who receives the mission to establish a strongpoint immediately conducts a joint reconnaissance with his supporting engineer to establish the optimum application of available assets. The strongpoint is prepared in accordance with the following broad priorities:

- Make the position physically impassable to tanks.
- Plan indirect fires to slow, disrupt, and canalize the advancing enemy.
- Protect the AT weapons with terrain, obstacles, infantry, and on-call, indirect fires.
- Protect the infantrymen who are protecting the antitank weapons.

The strongpoint, however, is an exceptional case. It will not be normal in every defensive situation for either mechanized or light infantry units.

The engineer will assist the infantry in preparation of the strongpoint based on the amount of time, manpower, equipment, and materials available.

The active defense anchored on a strongpoint is a countermobility tactic.

Engineer Tasks for a Strongpoint

Open Area

Prepare:

- Close-in obstacles to prevent being overrun by tanks.
- TOW positions.
- Hull-down positions for tanks.
- Dug-in positions for command, aid stations, and critical storage.

- Other obstacles — including minefield at ATGM and tank range.
- Dug-in protected interconnecting routes between positions.

Improve:

- Positions.
- Obstacles to include those which will increase the kill probabilities of your antitank weapons.

Built-Up Area

Prepare:

- Close-in obstacles to prevent being overrun by tanks.
 - rubbling of buildings.
 - street blockage.
- Protected positions in buildings.
 - TOW positions.
 - other positions.

- Other obstacles.

—intermediate area obstacles.
—long range obstacles.

- Protected interconnecting routes between buildings and within buildings.

Improve:

- Positions.
- Obstacles, to include those which will increase the kill probabilities of your antitank weapons.

BUILDING BLOCKS

The "Building Block" approach permits engineer efforts to be planned in terms of manpower, equipment, time, and materials for typical emplacement tasks. This concept provides flexibility to the engineer in that estimates can readily be made for any size or design of strongpoint.

This chart will give the engineer some estimate of time needed to construct the strongpoint to the size needed by the tactical commander.

POSITION/OBSTACLE LIST

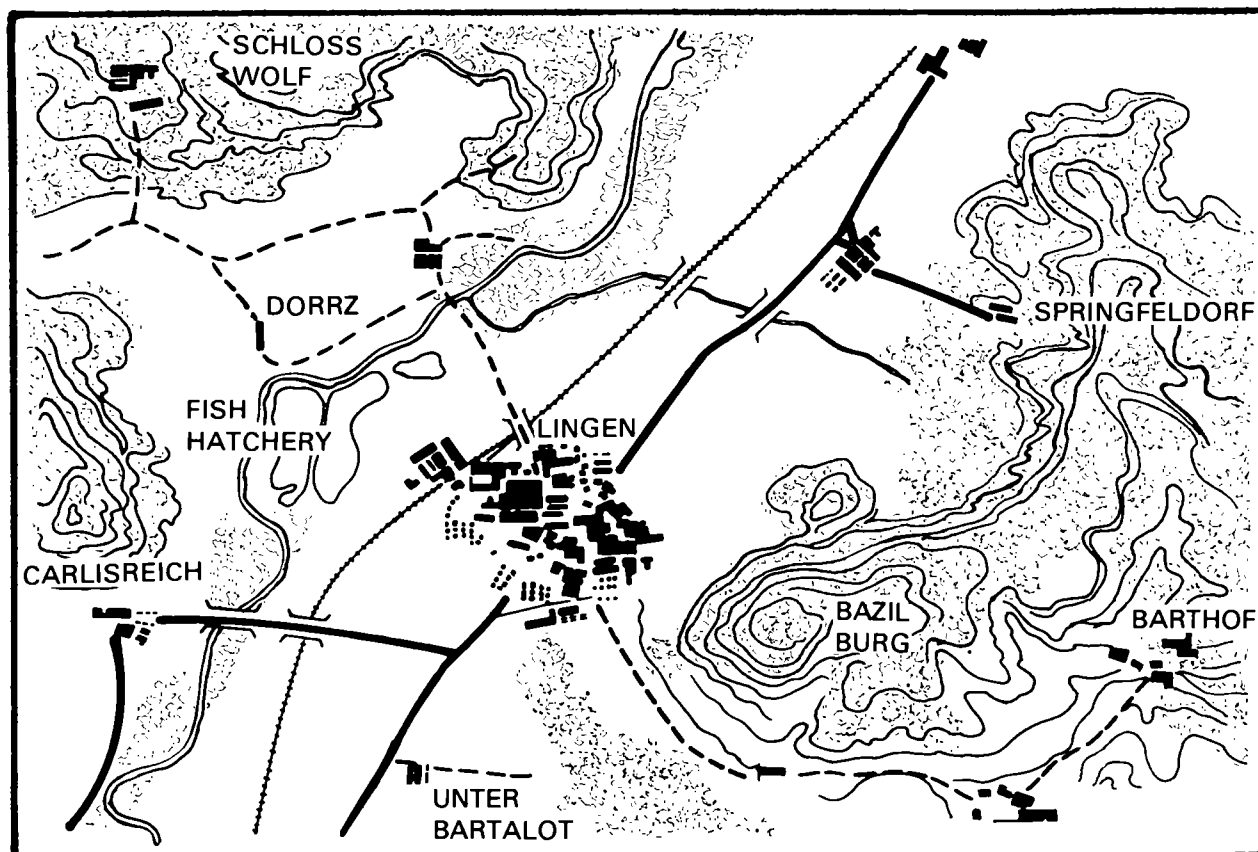
Position/Obstacle	Preparation Time
TOW/Position	1 sqd hr (handtools) or a 25 hr backhoe
Tank/APC Defilade	0.5 dozer hr
Trenches (2' x 4')	15 meters/hr backhoe
Triple Concertina Fence (100 m)	1 sqd hr
Mineplanter Minefield (300 m)	2 sqd hr and 1 hr for mineplanter
Hand Emplace AT Minefield (30 m)	1 sqd hr
4-Lane Bridge Demo (each)	2 sqd hr
2-Lane Bridge Demo (each)	1 sqd hr
Road Crater Using M180 Kits	0.5 sqd hr
Antitank Ditch (1.2 m x 3 m x 2.5 m)	1 dozer hr
Abatis (75 m)	1 sqd hr
Firing Ports in Wall (Mouseholes)	25 holes per 1 sqd hr

A STRONGPOINT DEVELOPED

The Situation

A brigade consisting of four battalion task forces is defending along a corridor. Its mission is to stop the enemy in sector, and prevent him from gaining access to the more favorable terrain.

The brigade commander looks at his sector from the enemy's point of view.



The highway in the valley is the only high-speed approach through the sector. This road is vital to maintaining the momentum of the enemy's attack and to his ability to sustain ground operations. The alternative is to attempt the time-consuming maneuver over restrictive terrain.

The brigade commander knows that the Threat will move its motorized forces on the high-speed avenue of approach. If he fails to control the road, the brigade defense will crumble throughout the sector. The brigade commander determines that a strongpoint is absolutely necessary to prevent a decisive penetration of his defensive system by enemy armor.

The best way to block the enemy is to establish a strongpoint in the valley.

The valley is open, flat, and approximately 4 km wide. The hilly terrain on both flanks provides excellent sites for battle positions. The Blau River and the marshy areas all along its course further narrow the valley. A succession of small villages along the valley floor provide excellent locations for battle positions, but fail to fully block the avenue. Only near the rear boundary of the sector does the town of *Lingen* offer a position which blocks the valley. In conjunction with the fish hatcheries, the Bazil-Burg, and Schloss Wolf, the town forms a *chokepoint*.

It fulfills all the requirements of a strongpoint for the tactical plan and can readily be established within the time constraints. The brigade commander assigns the mission to his mechanized infantry battalion. This battalion has its normally associated

engineer platoon and is also augmented with two platoons of tanks and an air defense platoon. The strongpoint must be ready in 10 hours.

Since the strongpoint preparation is critical to the brigade commander's mission, he may well decide to concentrate all or most of his normally associated reinforced engineer company's efforts to work with the strongpoint battalion task force. Our discussion will include only the engineer platoon supporting the maneuver battalion task force. The platoon has been augmented with equipment from its parent company that is supporting the brigade. This reinforced platoon and the *building block concept* provide the basis for calculating the impact of additional engineer platoons that may be available to augment the normally associated platoon's efforts. The discussion, therefore, presents the leanest engineer support that can reasonably be expected.

These are the engineer resources that would normally be within the battalion task force.

Combat Engineer Platoon Resources (Mech Div)

- 3 ten-man squads
- 3 armored personnel carriers
- 1 dump truck
- 3 squad demo sets
- 1 pioneer tool outfit
- 1 platoon demo set

The engineer platoon is reinforced with the company equipment for the strongpoint operation.

Equipment in Parent Company

- 1 M57 mineplanter
- 2 CEV
- 1 bulldozer
- 2 loaders, 2 1/2 cu yd
- 1 backhoe/loader

Engineer Tasks

These are the engineer tasks in preparing a strongpoint in a built-up area; however, the tactical commander could vary these as the situation changes.

- Close-in obstacles to prevent being overrun by tanks
- Protected positions
 - TOW
 - Other positions that exceed maneuver unit capability
- Other obstacles-
 - Intermediate area obstacles
 - Long range obstacles
- Protected interconnecting routes
- Improve positions
- Improve obstacles

The maneuver units can handle the bulk of the preparation of the individual and light crew-served weapon positions, allowing the engineers to concentrate on only a few key positions, the obstacles, and interconnecting routes. The combat engineer vehicle is assigned to work in the town where its demolition gun and blade could both be used to create and use rubble for positions, obstacles, and protected routes between positions. The bulldozer is also used for these types of tasks. The backhoe/loader is used to dig some of the antiarmor positions and trenches, both inside and outside the town. Although maneuver units are trained in demolitions and have them as part of their basic load, the engineer assists with needed technical advice in their use. Most of the initial demolition work inside the town is done by the maneuver units. The engineer platoon effort, to include demolitions, initially goes into building the obstacle system. When that is finished, the platoon will join the maneuver units in improving positions, using sandbags, rubble, and locally available building materials to strengthen walls, beams, and overhead cover. Engineer equipment continues to haul and position earth for sandbags and other shoring material.

Sequence of Effort

The sequence of effort applied to this operation would be as discussed below.

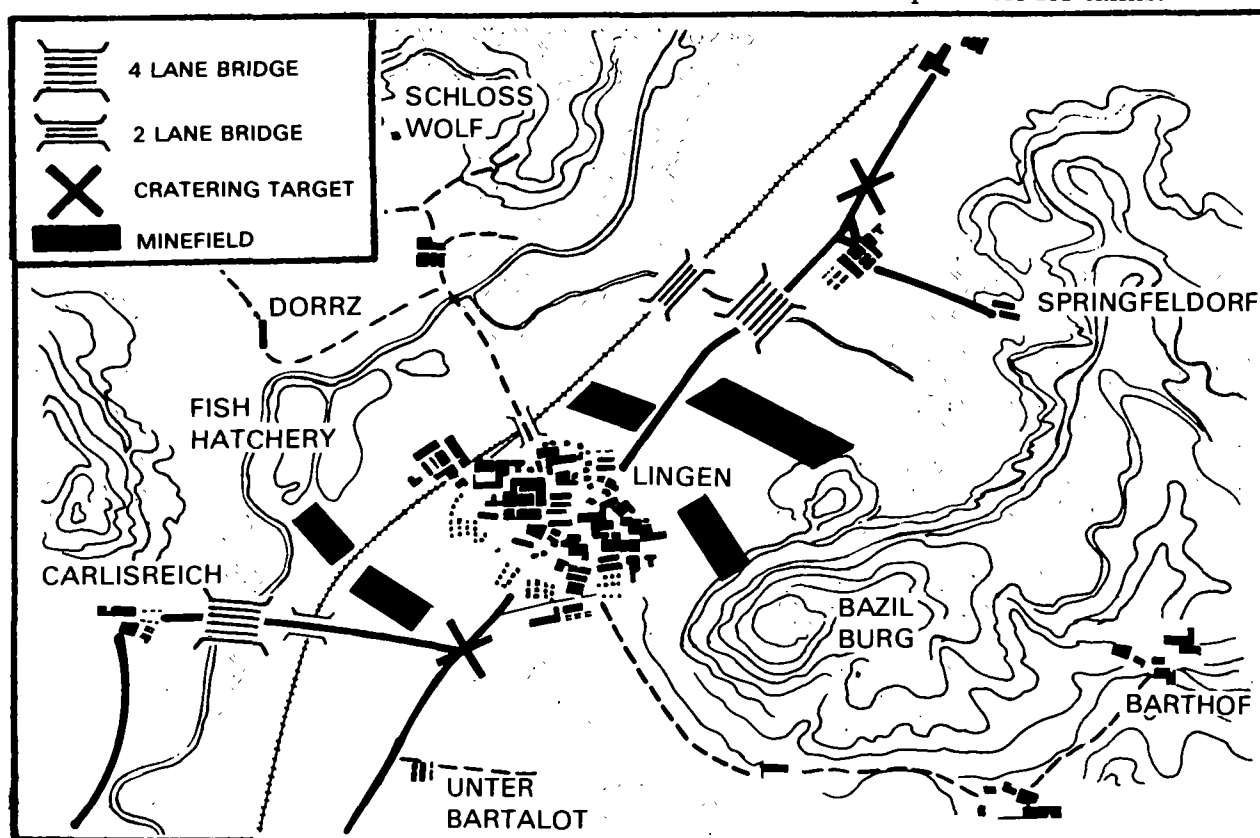
The maneuver units, with engineers assisting, start preparing fighting positions and shelters and putting in the protective obstacles, using materials from basic loads. An engineer squad uses explosives and assists the maneuver units in employing demolitions and strengthening buildings.

At the same time, the dump truck and loader stockpile earth in each maneuver platoon area for filling sandbags, and the dozer and CEV create and handle rubble for obstacles and covered routes. Outside the

town, the backhoe/loader digs antiarmor positions and the interconnecting trenches.

Concurrently, work begins by the engineers on the obstacle plan, which was worked out after a *joint reconnaissance* by the infantry battalion commander and his supporting engineer platoon leader. Figure 2 shows the plan, which ties in minefields, bridge demolitions, and road craters with the obstacles already present—

- the town,
- the sunken road, and
- the Blau river and its associated ponds, marshes, and steep slopes which are impassable for tanks.



Not shown on figure 2 is the selective rubbling of buildings and the use of demolitions in sewers to establish craters and obstacles in the town.

During the first 3 hours, one engineer squad works inside the town, strengthening positions. The remaining two engineer squads complete 900 meters of minefields, using the M57 mineplanter. Also during the

first 3 hours, the basic loads of mines and wire for close-in protection have been installed by the maneuver troops.

The general principle of installing obstacles from the inside out has been followed as closely as equipment capability will permit.

During the second 3-hour period, two

squads have installed another 900 meters of minefield, for a total of 1,800 meters. The squad that has been working inside the town has moved out to the tactical obstacle system and has prepared two 2-lane bridges for demolition and two road craters.

After 9 hours of preparation, an additional 900 meters of minefield have been installed for a total of 2,700 meters, and one 4-lane bridge has been prepared for demolition. If more time is available, the engineers will continue to work on the obstacles. The remaining tasks are 300 meters of minefield, and one 4-

lane bridge which can be completed in 1 hour. All the planned obstacles can be finished within 10 hours of preparation time.

Division engineers are best equipped to provide the *sustained* engineer capability needed by the strongpoint defenders.

The engineer equipment retained on the strongpoint should be only that needed to support the strongpoint mission. Equipment not required should be evacuated and utilized elsewhere by the parent engineer company.

This indicates the total engineer effort required to complete the obstacle system.

Task	Quantity Required	Effort Required
Minefields (M57)	3,000 meters	20 sqd hr
Bridge Demolition (2-lane)	2	2 sqd hr
Bridge Demolition (4-lane)	2	4 sqd hr
Cratering Targets (M180)	2	1 sqd hr

Summary

The commander's priorities of work insured that the absolutely essential tasks were accomplished first. As a result, the *position* could not be overrun by the Threat forces. The troops were protected from the effects of suppressive fires. Artillery, mortar, and small arms fires were integrated to stop the enemy's dismounted assaults. The strongpoint, however, is an exceptional case. It is not applicable to every defensive situation for either mechanized or light infantry units.



Appendix J

COMMUNICATIONS

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INTRODUCTION

Communications will play a critical part in the next war. Considering the area of the battlefield, the distances that engineer units will cover while performing their missions, and the increased capability of the enemy, all leaders will require a greater knowledge of communications and of the communications equipment available to them. This appendix will provide a general review of the communications capabilities available to engineer units.

RESPONSIBILITIES

Establishing communications is a command responsibility. Each commander is responsible for—

- Establishing communications to the lower headquarters.
- Establishing lateral communications from left to right unless directed otherwise by higher authority.
- Providing communications to supported units.

Each engineer unit of battalion size or greater normally is authorized a communications electronics (C-E) officer. The C-E Officer is responsible to the commander for the installation, operation, and maintenance of C-E equipment and for communications training programs. He has staff responsibility for establishing and enforcing communications security measures. He is the technical advisor to the commander in all communication matters.

Because of the tremendous importance of combat communications, the enemy will employ any and all means available to disrupt, exploit, or destroy our ability to communicate. *All personnel, therefore, must be trained in, and continually practice, good communications security techniques.*

CAPABILITIES

The communications section of the engineer battalion and each company is organized and equipped to install, operate, and maintain the unit's internal communications system with organic

communication equipment. The communications system provides for reliable, real time, frequency modulated (FM) voice radio communications. Field telephones with switchboard facilities provide an alternate means of communication. At battalion and higher levels of command, amplitude modulated (AM) radio teletypewriters (RATT) are available and provide a secure, hard copy means of communication. Multichannel systems provided by the division signal battalion are available to supplement the communications system. Messenger and audiovisual means are also included.

- *Single channel/VHF/RM radios are used for voice transmission at all levels in all divisions.* Radio systems are easier to use and faster to install than wire or cable systems, but they are highly susceptible to radio direction finding (RDF) equipment used by the enemy, even when they are used with security encoding devices. Using RDF techniques, the enemy can locate transmitters and receivers and, upon locating them, can direct artillery fires or aircraft on the location, can jam the transmission, or can monitor the transmissions for information.
- *High frequency AM radios are used at battalion and higher levels to pass RATT messages.* High frequency AM also provides a voice and continuous wave (CW) capability, but normally such use is restricted to division and higher communications nets.
- *Field wire and cable provide other means of communication.* Using wire communication eliminates the enemy's ability to locate units by using RDF equipment. Wire cable use is restricted by the distance between users; the time available for installation, maintenance, and recovery; and the user's desire for mobility. Wire is extremely vulnerable to damage by vehicles and weapons fire; it therefore requires extreme care in installation to preclude such damage. Although more secure than radio, wire is not in itself totally secure. It can be tapped and radiation devices can

intercept wire traffic. At battalion and company level, engineers have the capability to establish a radio-wire integration system whereby FM voice and wire traffic can be incorporated into the same net.

- *Messengers provide the most secure means of delivery* for large or bulky items, but they are relatively slow and are limited by the available transportation means.

COMMUNICATIONS NETS

General

In order that radio communication may follow the channels of tactical command, the radio station of a superior unit and the radio stations of its next subordinate units are grouped on the same frequency for operation with one another. This group is called a radio net and is composed of two or more radio stations operating together on the same frequency. Some examples of common nets are as follows—

- **Command net** - A net that is used for tactical control by the commander. Orders, coordination, and information of immediate intelligence value are types of traffic commonly passed over this net. Command nets are usually established with the highest priority.
- **Operations and intelligence net** - A net that is used to control operations and intelligence functions within the command. The net control station is located at higher headquarters.
- **Administrative and logistic net** - A net that is used for personnel matters and material supply information and requirements. This traffic does not have the same immediate tactical importance as the traffic on the command net. The priority for activation of an administrative and logistics net is usually much lower than for a command net.
- **Surveillance net** - A net that is established to coordinate activities of ground surveillance teams and receive reports

from them. Typical reports deal with enemy movements and concentrations.

Tactical FM radio equipment is the most frequently used means of communications within engineer battalions. Versatility is insured by the capability of vehicular-mounted and manpack sets. In addition, the battalion operates AM radios in the brigade or division RATT nets. Examples of RATT nets are the operations and intelligence net and the administrative and logistics net.

Engineer units usually have fewer dedicated radios than the traffic load warrants. Thus, effective operations demand economical management of both radios and nets. For example, during river-crossing operations, engineers can pool radio assets with collocated MP units and place only one of their combined frequencies in the crossing area commander's net, while each maintains a technical frequency.

Figures J-1, J-2, and J-3 are presented as samples of typical communications nets established within divisional engineer units. These illustrations are intended to reflect one example of employment in combat operations and give only general guidance to communications planners.

The engineer commander must plan for continuation of effective communications when his unit is attached to a maneuver element and is therefore no longer an integral part of the parent engineer unit net. Figure J-2 depicts a typical net control station (NCS) arrangement for an engineer company attached to a brigade. It is quite evident that the company will experience great difficulty in communicating with the engineer battalion during the battle. The FM (voice) net will be preempted by the maneuver element and the wire net cannot exist if the unit is moving. In this situation, the engineer company can communicate with its parent battalion only if prior arrangements have been made to use the battalion net and frequencies. The engineer company commander must have his NCS monitor the engineer battalion net and/or inform the battalion's NCS that he (the company commander) can be contacted on his company net. In any event, procedures to insure continuation of effective

communications between the engineer company and its parent battalion must be worked out before the operation begins.

Communications with Corps Engineer Units

During most operations in the division area, corps engineer assets will also be employed as part of the engineer system. All corps engineer units in support of the division will be under operational control of the division engineer. The units will receive missions from the division engineer through the assistant division engineer (ADE), normally located at division main CP. When entering the division area, each corps unit will establish communications with the ADE on a spare net specified in the CEOI -- a net designated for the corps engineer units, the division engineer battalion, and the ADE. This net will be used as an engineer command and control net in the division area, with the NCS at the ADE. The net will normally be on an FM frequency, but may be a multichannel frequency, established by the division signal battalion.

TRAINING

Training is the key to a successful communications operation. Every person

who has access to communications equipment must be well trained. This includes commanders at all levels, staff officers, and enlisted supervisors--as well as radio operators. These people must know how to operate equipment, how to use the CEOI, and how to maintain good security procedures. Time in training is available to learn and practice good communications procedures, as communication is a part of every training and field exercise. These training opportunities must be fully utilized.

Training must not be limited to the use of radio, teletype, and wire communications. If the enemy is successful in jamming friendly radio voice communications and friendly forces are moving too fast to use wire, some other means must be employed. In this circumstance, continuous wave (CW) International Morse Code can sometimes get through. Or, if all else fails, preplanned sound and visual systems must be used--such as whistles, bells, horns, flags, smoke, or any other sound or visual expedient that can be devised. Unless troops have practiced or trained with such devices for a similar situation, sound and visual systems will not work on the battlefield. How effectively communications will contribute to winning the next war will depend on how thoroughly communications training is conducted beforehand.

Typical Division Engineer Battalion Command Net (Wire and Radio)

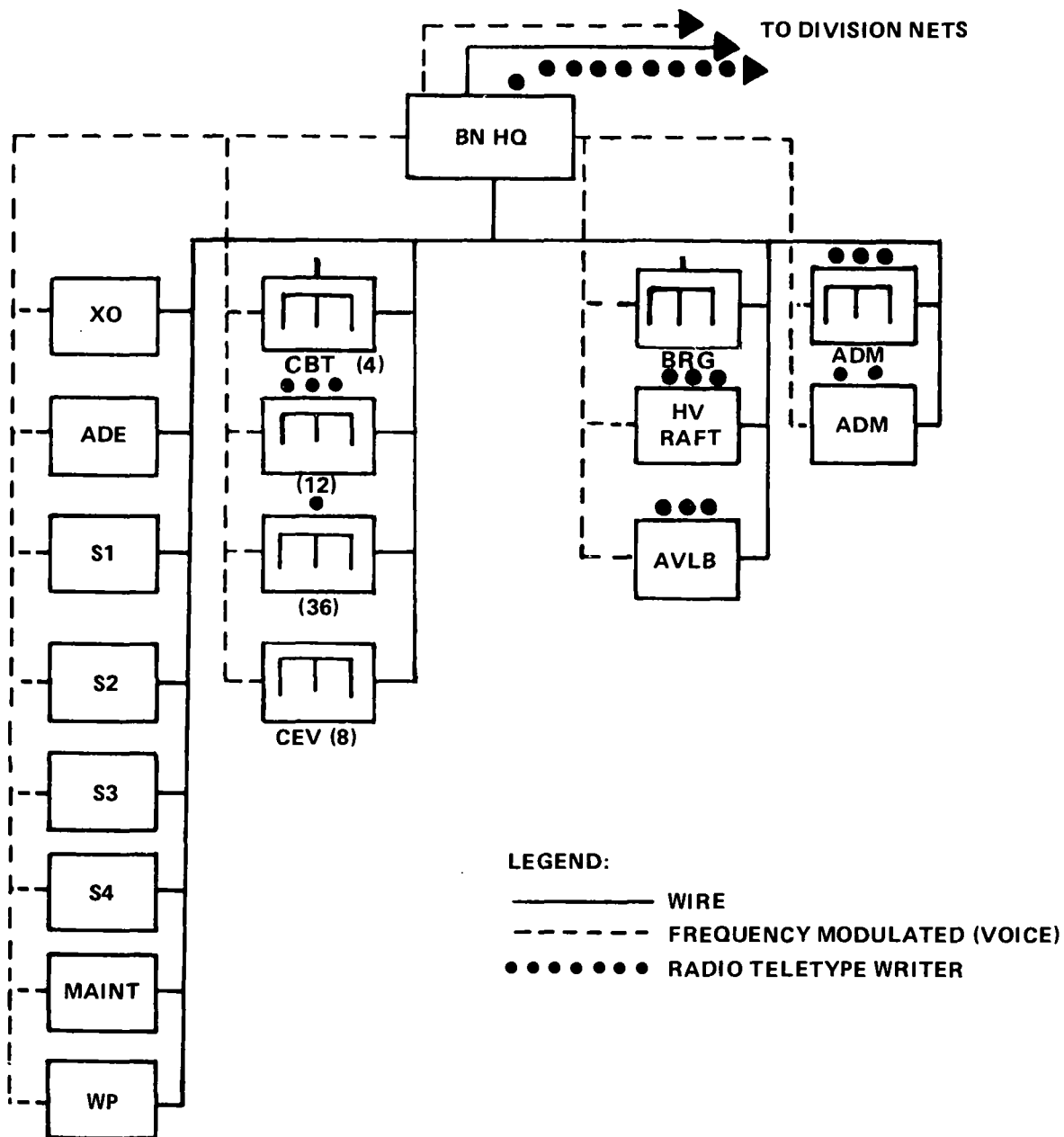
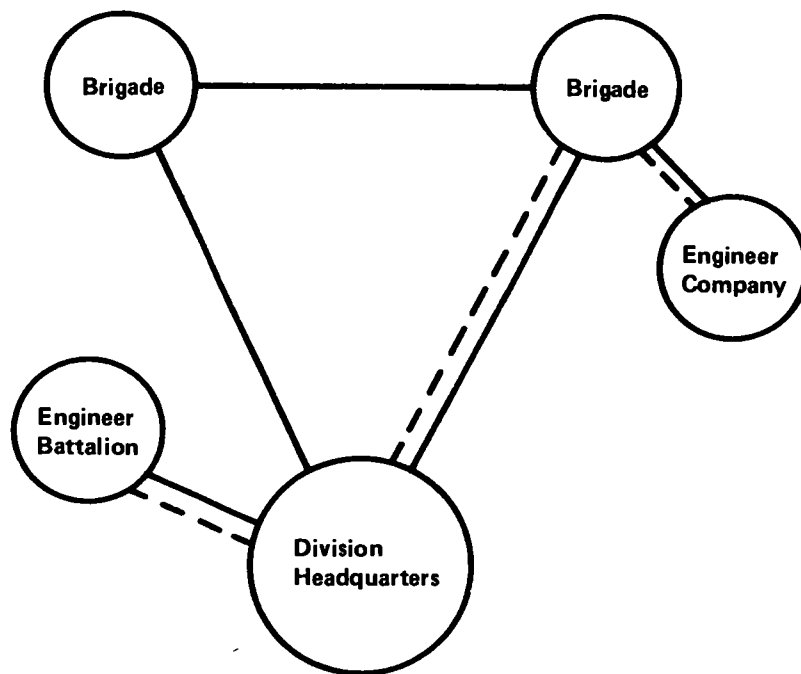


Figure J-1

Combat Engineer Communications



LEGEND: _____ **WIRE**
 ----- **FREQUENCY MODULATED (VOICE)**

Figure J-2

Division Engineer Battalion Telephone Communications System

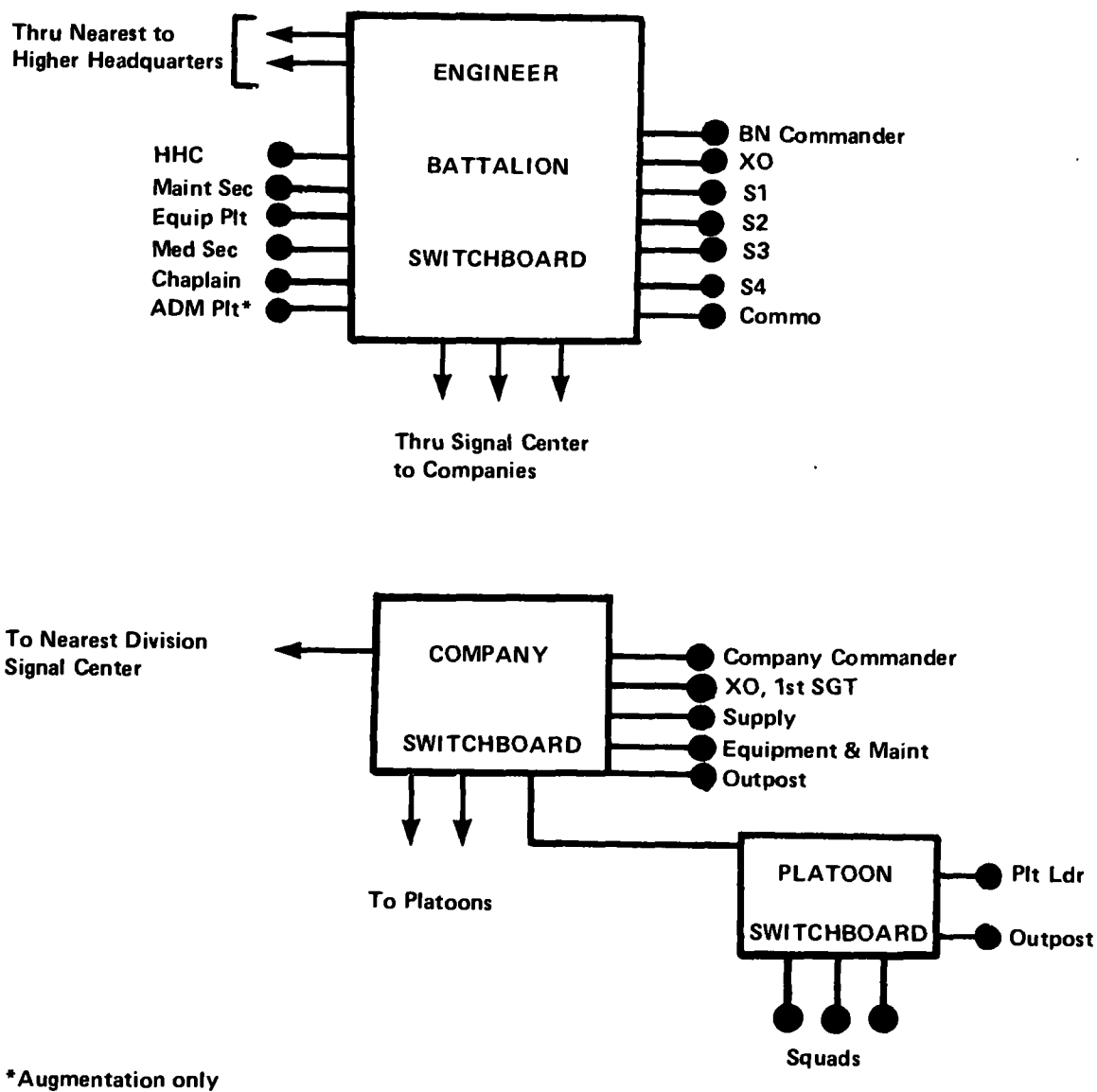
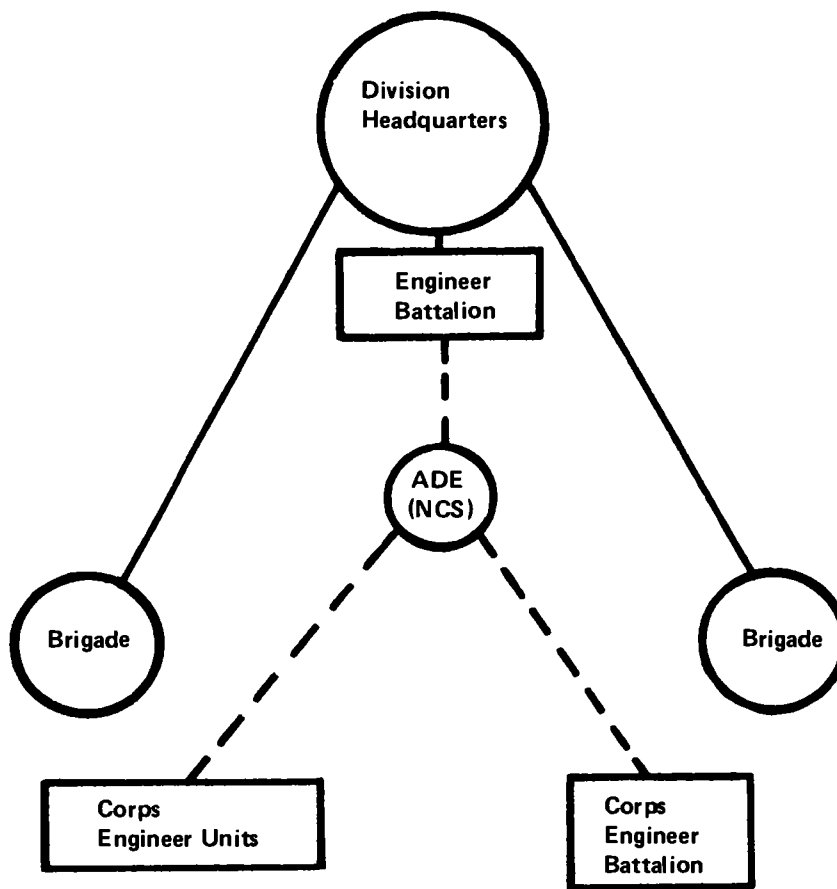


Figure J-3

Engineer Command and Control Net in the Division Area



LEGEND:

- Division Net
- - - - - Engineer Command & Control Net

Figure J-4

Appendix K

LIGHT
INFANTRY
OPERATIONS

Light infantry units include rifle, airborne, air assault, and ranger. They are ideally suited for close-in fighting against a force which has equal mobility or a mobility advantage which has been degraded by difficult terrain, obstacles, and/or weather; or which can be offset by surprise or stealth. In restricted terrain such as cities, forests, or mountains, light infantry units are also a challenge to enemy armor forces.

Light infantry units are uniquely flexible and mobile over all types of terrain and can rapidly displace by air and sea.

This appendix focuses only on the difference between the engineer effort with light infantry and the engineer effort with armored/mechanized infantry as discussed in chapters 3, 4, and 5.

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CAPABILITIES AND LIMITATIONS OF LIGHT INFANTRY

Capabilities

The organization and training of the light infantry unit make it especially suited to—

- Maneuver in areas that restrict the mobility of mechanized forces (e.g., obstacles, built-up areas, mountains, forests, and jungles).
- Move long distances and be prepared to fight upon arrival, when lift aircraft are provided.
- Quickly bypass natural or manmade obstacles.
- Conduct raids and infiltrate to seize or disrupt lightly held areas to the enemy's rear.

- Repel enemy infantry attacks and destroy enemy armor from prepared positions.

Limitations

Some limitations of light infantry are that it—

- Cannot move quickly unless augmented with transportation assets.
- Has less organic firepower than mechanized infantry.
- Lacks the protection necessary to permit freedom of movement while receiving enemy fire.
- Has limited protection from NBC effects.

Principal Equipment Differences

	MECH INF		RIFLE INF	ABN INF	AASLT INF	RANGER INF
TOW (Per Bn)	18	VS	18	12	18	0
MORTARS (Per Bn)	4 x 107mm 9 x 81mm		4 x 107mm 9 x 81mm	4 x 107mm 9 x 81mm	12 x 81mm	6 x 60mm
MOBILITY OF SCOUTS	M - 113 APC		¼ Tn Trk	¼ Tn Trk	Foot	None
MOBILITY	M - 113 APC		Foot	AC/Foot	Helicopter/ Foot	Foot
ARTILLERY (Normal Support)	155mm SP		105mm Towed	105mm Towed	105mm Towed	None

RIFLE INFANTRY

Employment Of Rifle Infantry

Rifle infantry units are employed in a variety of roles, but are ideally suited for close-in fighting against a force which has equal mobility. Jungle, mountains, heavily forested areas, and cities are examples of terrain where rifle infantry has a mobility advantage over mechanized infantry.

Dismounted infantry units may occupy deliberately prepared strongpoints in mutually supporting positions that can effectively block the advance of an enemy mechanized and armored force. In the assault of enemy fortified positions, dismounted infantry is used when obstacles have severely limited vehicular movement. The ability of light infantry to conduct pursuit and exploitation is limited by its lack of mobility. Under normal conditions, rifle

infantry units are not assigned a mission in the covering force area unless augmented with additional firepower and mobility assets.

Engineer Effort With Rifle Infantry

Engineers with rifle infantry units have an organization similar to that of their counterpart with mechanized infantry. The notable differences are 5-ton dump trucks instead of APCs as prime personnel movers, three line companies versus four in the mechanized engineer battalion, and one CEV compared with two in each line engineer company.

Division engineers must be capable of participating in the various operations in which the rifle infantry can be employed.

- ***Mobility.*** Since rifle infantry is dismounted, there is less need for engineers to provide the combat trails necessary for the mechanized operations. Additional effort is used to insure the mobility of wheeled resupply vehicles. Clearing of areas for helicopter landing zones also increases in importance.
- ***Countermobility.*** Countermobility efforts do not differ appreciably from those already discussed in chapter 4. An armor threat to rifle infantry, however, causes a greater expenditure of effort on antiarmor obstacles. To be effective, these obstacles must be integrated with antiarmor weapon systems.
- ***Survivability.*** Because of the limited organic protection from enemy fire and NBC effects, prepared positions are a necessity in defensive operations. Engineers must assist in the construction of fighting positions, especially TOW positions, and the covered routes between them.
- ***General Engineering.*** The same capability of general engineering is available from division and corps engineer units. An increased haul capacity is available due to the increased number of 5-ton dump trucks.

Fighting As Infantry

Engineers with rifle infantry units have less ability to perform infantry missions than engineers with mechanized forces, due to a decreased amount of weapon systems. The accompanying chart is a comparison of the capabilities showing the principal weapon systems of each type of battalion.

Command and Control

There is no appreciable difference in command and control functions between engineers in rifle infantry units and engineers in mechanized infantry units. However, radio distance capability is decreased for the engineer platoon leader in a rifle infantry unit.

AIRBORNE INFANTRY

Employment Of Airborne Infantry

Airborne infantry units have the ability to be committed with relatively short notice and move great distances by aircraft to objective areas.

Airborne infantry units have the capability to land in enemy rear areas and seize key objectives such as main bridges, communication centers, logistical bases, and command posts. Airborne infantry units often act as strategic reserve because of the speed with which they may be employed. With the support of helicopters, airborne units can conduct air assault operations. To carry out its airborne missions, the unit requires considerable Air Force support both initially and for resupply. Airborne units have limited protection against armor and are lacking in organic medium artillery support. They also require augmentation for sustained operations.

	ENGR BN, MECH DIV	ENGR BN, INF DIV
LINE		
COMPANIES	4	3
HV MG	51	7
LT MG	35	24
CEV	8	3
DRAGON	24	18

Engineer Effort With Airborne Infantry

Engineers with airborne infantry units have equipment specially designed to be delivered by parachute from aircraft. This is accomplished either by a heavy drop or parachute extraction. These techniques limit the size, type, and amount of engineer equipment assigned to these units. Since these units are limited in the amount of engineer effort that can be provided, the total strength of personnel is reduced as compared to an armor/mechanized engineer unit. Airborne engineer units must also be prepared for operations utilizing helicopters. Airborne engineer units do not have organic bridging equipment.

- **Mobility.** Logistical support through air resupply is a key factor in most airborne operations. After the initial assault, airborne engineer units are concerned with improving the landing areas for followup units, equipment, and resupply. Construction of forward airfields or Low Altitude Parachute Extraction System (LAPES) zones must begin immediately if the force is to conduct independent sustained operations. Airborne operations may be conducted to secure airfields in order to lessen new airfield construction requirements and provide early aircraft landing sites. Engineers provide routes for linking up ground forces through reconnaissance, upgrading existing bridges, and breaching obstacles.
- **Countermobility.** An airborne unit may conduct a countermobility denial operation against critical railroads, roads, or waterways. Points in these routes may have to be blocked or destroyed by engineers to insure their denial to the enemy. Obstacles are constructed to help secure the airhead and normal priority of emplacement goes to high-speed armor avenues of approach. Since amounts of barrier material available are limited, engineers must make maximum use of locally available materials in obstacle construction.
- **Survivability.** Rapidly prepared positions utilizing local materials are the rule in normal airborne operations.

Airborne engineer units have limited earthmoving equipment to help prepare these protective positions. An exception occurs when the force is involved in a sustained defensive operation. Then construction focuses on mutually supporting strongpoints and the covered routes between them.

- **General Engineering.** Corps engineer units which are capable of airborne operations can provide additional engineer effort to the division engineer battalion. The light equipment company (abn) is capable of deploying its earthmoving equipment and operators along with the division engineer battalion. The corps combat battalion (abn) may be included in the operations to construct forward tactical landing strips and free the division engineer battalion to conduct mobility and countermobility operations. This battalion also has the capability to provide additional combat engineer effort.

Fighting As Infantry

Due to the nature of airborne operations, engineers are called upon to fight as infantry more frequently than other types of divisional engineers. Airborne engineers have fewer personnel and weapons than comparable mechanized engineers. See the chart below for a comparison of capabilities.

	ENGR BN, MECH DIV	ENGR BN, ABN DIV
LINE COMPANIES	4	3
HV MG	51	4
LT MG	25	44
CEV	8	0
DRAGON	24	9

Command and Control

Normally, airborne engineer units are attached to maneuver units during the assault phase of the airborne operations. The unit reverts back to a direct support status

when the parent engineer headquarters has landed.

Once on the ground, reconnaissance activities concentrate on finding for airborne units routes that avoid reinforcing and existing obstacles. Routes must also be found which provide linkup with ground forces in the operation.

AIR ASSAULT INFANTRY

Employment Of Air Assault Infantry

Air assault infantry has the capability to bypass the enemy's forward defenses and attack command posts, logistical bases, and communication centers. By avoiding obstacles, difficult terrain, and contaminated areas, the air assault infantry can secure or destroy key objectives behind the front line positions. The inherent mobility of the air assault infantry provides the following advantages:

- The ability to delay on wide frontages.
- The ability to conduct wide area surveillance.
- Employment as a reserve capable of rapidly exploiting success.

The major disadvantages of helicopter operations are that—

- Adverse weather conditions will limit operations.
- Greater logistical support is required for the force.

Engineer Effort With Air Assault Infantry

Engineers with air assault infantry have equipment much the same as the airborne units. The equipment is designed to be air-lifted to the work site. The reduced size of the equipment results in a reduced work capability for the unit.

- *Mobility.* The key to success is often the ability of the engineers to rapidly construct or improve air landing sites for both rotary and fixed-wing aircraft. Initial effort for landing areas is expended in clearing obstacles and debris affecting the landing approach and

landing site. Under certain climatic conditions, dust palliatives, metal landing mats, or membrane surfacing materials are required. Since air assault operations are relatively independent of terrain influences, the engineer role in obstacle removal should decrease.

- *Countermobility.* Like the airborne force, the air assault force is vulnerable to attack by enemy armor. Air assault engineer forces emplace obstacles situated to give maximum time for anti-tank weapons engagement. Local materials should be used in construction of manmade obstacles since, normally, engineer supplies are limited.
- *Survivability.* Due to limited supply of Class IV materials, local materials are used in the construction of most protective positions. Engineers have a greater responsibility for the improvement of artillery positions, since the artillery lacks self-propelled mobility and is vulnerable to counterbattery fire.
- *General Engineering.* Due to the large quantities of fuel, oil, and lubricants required, engineer effort is necessary to establish forward area refueling and rearming points. Site clearing, leveling, and construction of protective berms are some of the missions which may be required. Necessary corps engineer assets normally are employed to develop forward airfields which will support Air Force medium cargo aircraft.

Fighting As Infantry

Unless furnished additional fire support, the engineer battalion in the air assault division has limited capability for infantry missions. The normal wide dispersion of the air assault engineer units means that chance encounters with enemy forces are increased. This means that commitment of the engineers as infantry will probably be at company or platoon level rather than at battalion level.

Command and Control

Map, aerial photographs, and aerial reconnaissance are essential in planning for

air assault operations. Engineers must emphasize detailed planning and control of assigned helicopter assets. Engineer equipment and personnel must arrive at the proper time and place on the battlefield to accomplish critical engineer missions.

RANGER INFANTRY

Employment Of Ranger Infantry

The ranger battalion is specially trained and organized to conduct decentralized and independent combat operations anywhere in the world. It may be called upon to-

- Establish a credible American presence to demonstrate US resolve.
- Conduct strategic and long range tactical reconnaissance, raids, and other combat operations.
- Infiltrate and exfiltrate by air, sea, or land, using parachute, assault aircraft, small boats, and Navy vessels, or moving overland on foot.

Engineer Effort With Ranger Infantry

There are no engineer assets organic to the ranger battalions. Engineer units can be attached on a mission basis; however, this engineer force must be tailored for the specific mission requirements. See the chart below.

	ENGR BN, MECH DIV	ENGR BN, AASLT DIV
LINE COMPANIES	4	3
HV MG	51	0
LT MG	35	46
CEV	8	0
DRAGON	24	9

Engineer Combat Operations
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**Appendix L
EVOLVING
CONCEPTS
IN MINE
DOCTRINE**

CONCEPTS AND DOCTRINE for mine warfare must change to keep pace with evolving hardware and the dynamic characteristics of the next war. The emerging concepts and doctrine discussed in this appendix are *not yet approved*, however, units should be familiar with the thrust and direction of current thinking.

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RESPONSIBILITY

Proponency for mine warfare rests with the corps of engineers.

The most effective means of achieving countermobility today and in the foreseeable future is by reinforcing the terrain through the use of mines. Other obstacle-producing means, such as abatis, craters, and tank ditches, are necessary, but mines are the single most effective and practical means. And mines will gain an increasingly important place in the next 2 to 6 years as new developments in rapidly emplaced scatterable mines come into the inventory.

Engineers must accomplish the countermobility tasks.

The limited number of infantry and armor troops actually available in the division organization to accomplish all combat missions demand that engineers take their place as active members of (and not just advisors to) the combat arms team. The emerging concepts for mine warfare recognize this.

The practical consideration that makes this changed concept possible is the family of scatterable mines (FASCAM). FASCAM, which was perceived several years ago and undertaken as the solution to our dilemma of the gap between capability and needs in mine warfare, is now close to reality. We already have one of the FASCAM systems in the field today and the next 2 to 6 years will see the fielding of the complete system.

FASCAM, in conjunction with limited use of conventional mines, provides the real world material capability required for the new concept of mine warfare.

PRECEPTS

- New hardware
- Dynamic placement capability
- Engineers as the primary emplacers
- Engineers to advise and plan mine use
- Organizational flexibility
- Mine use on the new battlefield

◦ Need for lower level employment authority

The emerging capabilities of the FASCAM system make *mines the most practical and effective means of reinforcing the terrain*. Other obstacles to reinforce mines, such as craters and abatis, are planned for and emplaced as time and available resources permit. The rapid and standoff delivery capability of some of these FASCAM systems allows for the emplacement of minefields in a "dynamic mode," geared to the actual movement of enemy forces. The self-destruct characteristics of FASCAM, however, require consideration of conventional, long-term minefield obstacles in certain tactical situations.

The *engineers* as full members of the combined arms team *will be the primary "doers"* as well as advisors for mine warfare. Infantry and armor maneuver force participation in mine placement will be extremely limited simply because each will be primarily concerned with its own missions.

Planning for and advice on the employment of all mine systems will be the *responsibility of the engineer*. The physical employment of FASCAM and conventional mine systems rests with the engineers, except for artillery- and air-delivered mines.

The *division engineer*, as the planner and primary "doer" of mine warfare, wears two hats. He is a division special staff officer for the planning function and the commander of the organic engineer troops of the "doer" function. He has a staff section under an ADE to assist him in the minute-to-minute coordination at division headquarters. The *ADE must be physically located in the division* with the G3 to facilitate the proper integration of mine warfare with division operations. The division engineer, as a commander, commands the divisional engineer troops who advise subordinate maneuver commanders on the mine warfare system and who are the primary "doers" in the emplacement of mines except for artillery- and air-delivered mines. The division engineer is responsible for the control and efficient employment of all engineer assets, to include supporting

engineer units, in the division's area of operation.

The engineer organization must provide for the effective and timely use of the new mine warfare systems. The organization must have the ability for flexible and rapid response to provide for the distribution of mine system resources to the critical areas of the battlefield as determined by the division commander.

Direct support of engineers to maneuver elements must allow engineer mine warfare assets to be moved to other, more critical areas as directed by the commander. Such a movement of engineer mine warfare assets will provide augmentation in those areas where it is required. The engineer organization must provide for necessary command and control to facilitate effective flexible response and rapid reinforcement. The mine systems physically employed by the engineers in the division area are employed in the forward areas and require, due to system constraints, the physical presence of engineers in brigade and battalion maneuver force areas. Unlike artillery- and air-delivered mines, the systems physically employed by the engineer must be moved on terrain to or in relatively close proximity to obstacle sites.

The self-destruction time characteristics of the FASCAM system require a change in traditional "*authority to employ*" considerations. In general, *the shorter the self-destruction time, the lower the command level of employment authority*. The rapid, dynamic delivery capability of some elements of the FASCAM system and the need for timely response to observe targets also support a general reduction in the level of command for authority to deploy certain mine systems.

MINEFIELD TYPES

General

Minefields must be categorized and defined consistent with the new systems capabilities and their use as the primary means for enhancing the terrain. The following definitions are consistent with these requirements:

- **Protective**

Hasty

Deliberate

- **Tactical**

- **Point**

- **Interdiction**

- **Phoney**

Protective Minefields

Protective minefields are of two types: hasty and deliberate.

Hasty is used to aid a unit in its local close-in temporary protection. It—

- Is short term
- Employs unit's basic load.
- Is easily detected and removed by laying unit.
- Is composed of MOPMS and/or conventional hardware.

Deliberate—

- Provides for protection of local units in MBA and for strongpoints or for semipermanent installations.
- Employs unit's basic load augmented by engineer assets.
- Is placed at optimum range of small arms, machineguns, and mortars with selective use on armor avenues of approach at optimum range of unit's antiarmor.
- Is composed of MOPMS and conventional hardware.

Tactical Minefields.

Tactical minefields are used as part of a deliberate defense or abstacle plan to—

- Stop, delay, canalize, and/or kill enemy forces.
- Enhance friendly weapons fire.
- Protect flanks or friendly units.

They—

- May be pre-emplaced or “on call” by dynamic delivery means.
- Are not easily bypassed, if tied to terrain of poor mobility.
- Are sited to make optimum use of maximum effective ranges of TOW, tank, and Dragon weapon systems.
- Include hardware of all FASCAM systems (except GATOR) and conventional mines.

Point Minefields

Point minefields are used primarily in the dynamic mode for targets of opportunity as the battle develops, but also use preemplaced conventional mines for small point areas which are critical. Point minefields—

- Are used to disrupt actual enemy maneuver, to kill and to develop targets for our weaponry.
- Are used to force the enemy to deploy.
- Are used to prevent enemy use of key areas.
- Include hardware of all FASCAM systems and conventional mines.

Interdiction Minefields

Interdiction minefields are used beyond the range of division weapons to harass and disrupt enemy activity in his rear area.

- They consist of GATOR or MOPMS and conventional mines employed by irregular forces.

Phoney Minefields

Phoney minefields—

- Are used to deceive the enemy.
- Use live mines.
- Are of little value unless enemy has become mine conscious.

MINES IN THE DEFENSE

Threat Attack

Three basic forms:

- *Meeting engagement*
- *Deliberate (Breakthrough)*
- *Pursuit*

Of primary importance is the *breakthrough attack*. It will be carried out against well-prepared defenses in which no gaps or flanks can be found. The attack will be preceded by a thorough reconnaissance and sufficient engineer work to clear lanes through known enemy obstacles. The Threat prefers to lead with tank units. It may lead with motorized rifle units if the terrain is too unfavorable for tank units or if the defender has heavy antitank defense. The Threat will rarely employ one type of unit (infantry, tank, artillery) exclusively. For example, tanks will accompany motorized rifle units and motorized rifle units will accompany tanks. The breakthrough attack will rely heavily on maintaining the tempo of the attack, minimizing the time available to employ defensive antiarmor weapons, and achieving flank security primarily by an aggressive advance. The Threat will employ dismounted forces if faced with strong positions or indications of a strong coordinated defensive fire system.

Covering Force Area

Engineer Role

In the covering force area (CFA) engineers are normally in the attached role.

Protective Minefields

Protective minefields will have limited use in the CFA. If used, they will be emplaced and removed by maneuver units. Armor-heavy CFA units normally will not allow the Threat to close on their locations to a point where close-in protection is needed. The CFA forces will deploy frequently and immediately after engaging the enemy to avoid return fire and delay necessitated by retrieval of protective mines. The time required for retrieval of mines (even undispersed modular pack system mines) will generally be prohibitive. As an exception, if CFA units are required to hold and kill the enemy forward of the MBA for a specified period of time, they will require

close-in protection. The MOPMS, which will be part of the maneuver unit's basic load, will be used in this role. It will be employed to delay the enemy at optimum ranges and locations for engagement by direct fire systems. It is not envisioned that conventional mines will be employed to improve battle positions. Battalion has the authority to employ, but may delegate this to company. Dispersed MOPM protective minefields in the CFA will be reported to higher headquarters through battalion level.

Tactical Minefields

Highest priority for tactical mining will be given to the decisive battle in the MBA. However, the Europe¹ Scenario does include some tactical minefields in the CFA. First priority for use of these assets should be to block high-speed avenues of approach into the division area. Tactical mining at this point in the battle should be selective, with relatively few minefields of high density being employed where they have the highest probability of influencing the battle. Engineers will emplace conventional minefields, using mechanical mine planters, with minimum hand emplacement in irregular pattern to confuse the enemy. These conventional minefields must be emplaced between alert and commencement of the battle. As the CFA battle develops and Threat intentions and dispositions are defined, M56 systems can be delivered by helicopter. These systems will be used to thicken the obstacle plan at small, selected points between CFA forces and the MBA in order to strengthen critical positions in-depth. Nap-of-the-earth tactics will be required. The engineers' ground-emplaced mine scattering system can establish fast tactical minefields to the rear of CFA forces at critical points as they are defined. Engineers will use MOPMS to close lanes as friendly forces withdraw. All of these systems (GEMSS and MOPMS) will be in the normal engineer task organization for the CFA and the engineer plans for and advises the covering force commander on their use. The advantage of FASCAM systems in this scenario will lie in their selective use as the battle develops to thicken the CFA defensive system at selected, optimum points. It is

essential that these FASCAM minefields be closely integrated into planned CFA defenses in-depth to tie in with direct fire capabilities. The division commander will be responsible for authorization and coordination of tactical mining with delegation to the covering force commander. M56 minefields will be primarily employed in friendly areas because of delivery system vulnerability. The fields in friendly areas will be premarked. GEMSS minefields are easily premarked, or marked while mining is in progress (mines have a long arming). MOPMS minefields will be unmarked and placed forward of friendly units or in locations which do not impede the CFA's retrograde. It is essential, because of the defense in the CFA, that tactical minefields be reported to all subordinate, adjacent, and higher headquarters. Reports for GEMSS and conventional minefields will be made through division and, for all other minefields, through covering force (brigade) headquarters.

Point Minefields

Conventional point mining will be common in the CFA to delay and disorganize the Threat along main avenues of approach. Point minefields will also be used to deny the enemy access to forested areas or other concealed approaches into the division area. Fords and bridges not to be used by friendly forces will be mined conventionally (by engineers) as will any other specific sites that must be denied Threat use. Point minefields by themselves are easily bypassed and cause minimal delay or casualties. Their advantages early in the battle are in their effect on the enemy unit in terms of mine consciousness, and their potential delay and attrition if properly tied into existing or reinforcing obstacles. As much as possible, they should develop direct fire targets at optimum ranges. Point FASCAM mine *planning* should be done by the engineer in advance of the battle, identifying and recording likely requirements for point mining based on most probable enemy courses of action. Planned targets decrease reaction time and increase accuracy of employment when the mission is actually needed. As the battle develops, targets of opportunity will be identified,

requiring augmentation of the obstacle plan to fit the actual enemy situation. Artillery-delivered FASCAM systems will be extensively used because of their inherent flexibility in being employed against known targets at optimum locations. ADAPM will restrict the Threat from dismounting motorized rifle troops in forested or other congested areas. ADATM minefields should usually include ADAPM mines to hinder breaching activities by dismounted forces. Artillery FASCAM will be used to close gaps and lanes in tactical minefields and to reclose breaches made by Threat forces. It will be used to deny enemy use of selected fording sites and bridges after friendly units have passed. The optimum use of artillery-delivered FASCAM systems is to place the minefields in the midst of the Threat formation. The minefield can no longer be easily bypassed or avoided; the Threat will be delayed and exposed in getting out of the minefield and subjected to attrition directly by mines as well as by direct and indirect fires. Time required for arming must be considered in this use of FASCAM. As the battle develops and counterbattery targets are identified, ADAPM in a counterbattery role will cause confusion, delay and attrition of the target unit. Used prior to a high explosive (HE) or dual-purpose improved capabilities missile mission, FASCAM will hold the enemy unit in place or cause casualties as he tries to move out of the fires. The responsiveness and accuracy required to accomplish this tactic indicate that *FASCAM point mining authority, for short self-destruct time systems only, must be delegated to battalion as the situation demands.* With authority retained only above battalion level, planned targets could be fired, but the inherent flexibility of using ADAPM/ADATM systems to react to a fast developing situation would be lost. Normally, point minefields will not be marked. Reporting of FASCAM point minefields having the shortest self-destruct times should be required no higher than covering force (brigade) level. *FASCAM with longer self-destruct times and conventional mines will be reported up through division.*

Main Battle Area

General

The decisive battle to destroy or repel the enemy is fought in the MBA. Based on the enemy situation developed by the covering force action, forces in the MBA will be concentrated against the main enemy thrusts. As a result, forces will be unequally distributed laterally and will have varying missions, depending on whether or not they are in the area of concentration, on the enemy forces in sector, on terrain, and on troops available to the commander. Unlike the CFA, MBA units have a rear boundary dictating the limit to which they may allow enemy penetration. MBA forces are more likely to be required to hold key terrain or to hold the enemy forward of a specific line, for a certain amount of time or indefinitely.

Protective Minefields ^o

MBA forces will more frequently employ extensive protective minefields. MOPMS will replace the current maneuver unit's basic load of conventional mines and will be placed by units at optimum small arms range where small arms, machineguns, artillery, and mortar fires can be brought to bear as the enemy force encounters the obstacle. If the Threat is expected to be tank heavy or if the motorized infantry will likely be mounted, MOPMS will be emplaced by engineers to increase enemy exposure to direct AT fires and observed artillery fires at optimum range. MOPMS and/or conventional mines will be employed by engineers in unobserved areas to prevent surprise attack into company battle positions. Engineers will improve unit defensive positions by the use of conventional mines. Only conventional mines will be marked; MOPMS will not be marked. Battalion will have the authority to employ, but may delegate this to company. Reporting and recording will be required up through brigade.

Tactical Minefields

Mining engineers will be extensive in preparation of the MBA. Mining will be done to deny the enemy use of high-speed approaches and to deny his movement through the cover and concealment of forests. Minefields should disrupt his attack, divert him into areas where he can be most effectually fought, and delay him in ideal positions for engagement by direct and

indirect fires. Mining will be planned and executed by engineers to strengthen the MBA in depth. Priority of mining will be from forward to rear. Normally, three minefield belts will be emplaced, each belt to optimize respectively the effectiveness of TOWs, tanks, or Dragons. Intervisibility must be carefully considered in siting these minefield belts. Because conventional mining is labor and time intensive, most mining, before the battle is developed, will be done by GEMSS. However, conventional mining using the mine planter will be done as time and terrain permit. Hand mining may be required for areas not accessible by the mine planter or GEMSS. As the battle develops and Threat intentions become clearer, M56 systems can be used in areas out of direct enemy fire to strengthen the obstacle plan in support of specific battle positions in-depth. GEMSS can also thicken the obstacle plan where the enemy thrusts are finally identified. MOPMS will be used to close necessary withdrawal lanes. All tactical minefields will be marked by engineers with the exception of MOPMS. Division will have the authority to employ, but may delegate this to brigade. Reporting and recording will be required up through corps.

Point Minefields

Point mining will be done conventionally prior to the battle by engineers and by artillery (ADAPM/ADATM) as the battle develops, as described in the CFA portion above. FASCAM will be used to close gaps and lanes, to reclose enemy breaches, to deny specific areas, and to force the enemy to deploy. However, its greatest benefit will be when it is used aggressively and offensively as the battlefield is accurately defined to develop targets and for counterbattery fires. Command and control considerations will be the same as for the CFA.

Rear Area

General

Division will control the area behind the brigade rear boundaries. Division command and control facilities and support activities will be located here. Any task forces retained as division reserves might be located in the rear area, although they may be located in

the MBA. The objective of the Threat breakthrough attack will be to destroy or disrupt these rear area facilities and, as a consequence, break up the integrity of the entire defense. corps will have the authority to employ mines in the rear area, but may delegate this to division. Reporting and recording will be required up through corps.

Protective Minefields

Protective minefields will be used for close-in security of such facilities/sites as command and control facilities, trains, ASPs, and air defense sites.

Tactical Minefields

FASCAM systems will introduce a capability to use tactical mining to react to rear area threats. Airborne or airmobile Threat forces can be contained by FASCAM, allowing time for reaction by a more mobile division reserve. Airmobile and airborne Threat forces in our rear areas will depend heavily on early linkup with main attack forces. GEMSS can be used to prevent reinforcement of these forces, allowing for their eventual defeat in detail. An armored Threat force in the division rear can be delayed and canalized in the same manner. The supporting corps engineers, coordinated by the division engineer, will provide the mine assets for tactical minefields in the rear areas.

Point Mining

Conventional point mining will be limited in the rear area. ADAPM/ADATM will be relied on to react to specific threats. Airborne and airmobile forces, in particular, will be extremely vulnerable to the delivery of artillery-delivered antipersonnel and antitank mines onto their DZ/LZs and assembly areas, since they are not readily equipped to cope with an extensive mine threat. Point mining against Threat mechanized forces in the rear area will follow the same concepts as for the CFA and MBA. The GATOR, although primarily an interdiction mining system, can be used against rear area targets if other divisional assets are not disposed for timely reaction.

Interdiction Mining.

Air Force GATOR mines and the general support rocket system (GSRS) will be used for interdiction of second echelon forces. They will be employed on assembly areas and on columns. Ideally, the use of these systems will be predicated on firm intelligence, and their employment will be complemented by tactical air (or other) attack on a disrupted, disorganized force. Both of these mining systems can be used to deny the enemy use of key areas, (either facilities or locations) such as critical communications nets. These mined areas will not be marked and, because of their distance from the defensive area, will pose no threat to friendly maneuvers because of their self-destruct feature. Normally, authority to employ will be retained at corps.

Phoney Minefields

Phoney minefields are used to deceive the enemy and will become effective when the Threat has become sensitive to our mining operations. They should be used as an economy of resources. Phoney minefields will be governed by the same employment, reporting, and recording doctrine as the minefields they simulate.

MINES IN THE OFFENSE

- Movement to Contact
- Hasty or Deliberate Attack
- Exploitation and Pursuit

General

The Threat defense will organize in successive belts designed to provide depth to the defended area. Each belt will consist of a series of mutually supported, self-sufficient battalion defense areas designed to be manned by motorized rifle battalions with artillery, mortars, and tank support. A large mobile reserve will be held in assembly areas for each defense belt. Defending units will remain in place until overrun or ordered to withdraw; however, occupation of alternate and supplemental positions within the defense area will be normal. The Threat will expect penetrations in gaps between units and intend to accomplish maximum killing in these areas. Unengaged adjacent units

may attack the flanks of attacking enemy forces. Local counterattacks, employing small tank forces, will be employed by the battalion to maintain the integrity of their defense area. Penetrations of the first echelon will be counterattacked by small tank forces from the regimental reserves.

The introduction of FASCAM systems will add a new dimension to offensive planning and execution. It will effect the phases given in the paragraphs that follow.

Movement to Contact

In the movement to contact, FASCAM mining should be used to supplement reconnaissance on the flanks to provide security for the main body. Once contact is made in the Threat security area, point mining by artillery mines will suppress and detain enemy security elements, allowing the attacking force to bypass and maintain the momentum of the attack. Artillery mining will be used to block high-speed approaches into the unit flanks as the force continues toward the main defenses.

Hasty or Deliberate Attack

Once contact is made, the enemy situation will be developed sufficiently to identify enemy disposition and weakness. Regardless of what form of maneuver will be used in the attack, the goal of the operation will be to concentrate superior combat power at weak points. Breaking through the enemy defenses will allow attacks on combat support, combat service support, command posts, and communications in his rear area. The key to a successful attack, assuming that an envelopment of forward defenses is not possible, will be to isolate that portion of the battlefield to be attacked and concentrate sufficient combat power to destroy the enemy strongpoints. Once a strongpoint is lost, mutual support within the defensive system will be disrupted, and friendly forces can maintain momentum in driving into the rear areas. ADATM/ADAPM mining can be used to suppress adjacent strongpoints and to isolate the objective by blocking likely routes of counterattack and reinforcement. Artillery mines can be used to hinder withdrawal of the enemy force. FASCAM used beyond objectives to prevent withdrawal will require

use of limits of advance as a control measure to prevent friendly casualties. All FASCAM mining in the attack must be judiciously placed and accurately reported so that such mining will not interfere with follow-on units whose mission is to avoid excessive delays by pockets of resistance, retain the initiative, and drive to the rear. FASCAM can reinforce the supporting attack by placement on selected enemy positions, preventing an enemy maneuver to counter the main attack. GATOR and GSRS will be used in the interdiction role to attack reserves in-depth, deny high-speed routes of advance and withdrawal, and disrupt or destroy support and command facilities. ADAPM/ADATM and GATOR will be used against enemy indirect fire units and ADA systems in the depth of the battlefield. Wherever possible, these minings will be coupled with direct attack by tactical air, HE artillery, or other means.

Exploitation and Pursuit

The exploitation will be conducted as a series of movements to contact and hasty attacks. The ideal conclusion of the attack is in the pursuit, which has as its purpose the destruction of the enemy force. When the withdrawing enemy is identified, Artillery systems can utilize their extended range to place obstacles beyond the enemy and in areas which will isolate him and prevent his withdrawal or reinforcement. Further, FASCAM uses will be as in the attack. Again, use of artillery-delivered mine obstacles to stop the enemy will necessitate the use of limits of advance to protect friendly forces.

COMMAND AND CONTROL

A concept for command and control of mine warfare which is based on the new emerging capabilities is as follows:

Authority to Employ

The authority to employ mines will be guided by the same principles as current doctrine which retains authority at the highest level expected to control maneuver over the area actively mined. However, the new dimension of time (time of self-destruct and time required to employ), adds a new aspect to the consideration. Short self-destruct times and rapid dynamic

employment times can necessitate lowering of the authority level for certain FASCAM systems and for certain minefield types.

Employment Procedures

Minefields will be *preplanned and disseminated* in an engineer-prepared "obstacle" annex to operations plans at all appropriate levels. Minefields shown will be directed for execution at specific times or "on call" at the request of commanders having the authority to employ.

"On call" missions and targets of opportunity will be requested through normal fire support channels. Depending on the system utilized, execution will be by artillery, air, or engineer elements.

The desirability of *covering minefields by direct fire* will remain valid. However, this concept might present situations where coverage by direct fire would be impractical. Indirect fires as a minimum should be used to preclude ease of breaching operations by Threat forces.

Reporting and Recording

Reporting and recording will be *simplified* for surface mines since their neutralization by friendly forces does not require elaborate and detailed plot plans as for buried mines. However, the increased frequency of mining operations demands that simple "cookbook" template methods be used to insure rapid recording at all applicable command levels. Conventional mining patterns must be simplified in recognition of the limited resources and time available to emplace minefields.

Reporting should be by *secure radio* and minefields recorded on situation maps at all levels up through the level of employment authority. An essential element of reports and records will be the time of dispersal and time of self-destruct. Procedures should be included in the unit CEOI.

Control Measures

The use of fire control lines, limits of advance, and restricted areas to maneuver will increase significantly the protection of friendly forces from our own—especially unmarked—minefields.

LOGISTICS CONSIDERATIONS

The FASCAM AT mine weighs about 1/5 that of the conventional AT mine. Initial raw data from Tactical Effectiveness of Minefields in the Antiarmor Weapon System (TEMAWS) test indicates that minefields containing far fewer mines than prescribed in current doctrine may be effective. Dynamically emplaced minefields based on actual Threat maneuver could reduce the current preemplacement requirement of minefields based on total enemy capabilities.

Offsetting considerations are:

- The expected greater use of mine warfare.
- The self-destruct characteristics of FASCAM.

Appendix M

OPERATIONS SECURITY (OPSEC)

Operations security is the protection of military operations and activities resulting from the identification and subsequent elimination or control of intelligence indicators which are susceptible to hostile exploitation.

This appendix will give the engineer insight into security measures during mission operations.

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RESPONSIBILITY

Operations Security (OPSEC) is a command responsibility. Since the operations staff (G3/S3) assists the commander in the overall planning and execution of operations, it also has primary supervision for the OPSEC function. Commanders must insure all staff efforts, including intelligence, communications-electronics, logistics, maintenance, and administration, consider OPSEC in providing maximum protection for an operation.

OPSEC can assist the commander in achieving surprise and security—vital elements to battlefield success. Frontline battalions and all supporting units must practice OPSEC and other coordinated acts to deny operational information to the enemy. Failure to effectively use OPSEC can endanger the units' survivability on the battlefield.

HOSTILE COLLECTION THREAT

The enemy will attempt to learn about your plans and capabilities in order to gain a tactical advantage. He has many methods to do this. The categories of intelligence collection are:

Human Intelligence (HUMINT) — Using people to gather information.

Examples:

- Local population.
- Intelligence agents disguised as friendly troops to keep track of loose talk and information posted on maps and jeep windshields, and to gather written materials improperly safeguarded.

- Ground and aerial reconnaissance.

Signal Intelligence (SIGNINT). Using devices to intercept our telecommunications and other electronic signal emitters.

Examples:

- Telecommunications intercept by wire tap or radio monitoring.
- Emission monitoring from radar and

other signal emitting devices.

Electronic Warfare (EW). Using EW assets to intercept, direction find, jam, and deceive us.

- Intercept techniques to identify EW targets.
- Direction finding to locate EW targets.
- Imitative communications and jamming to confuse or cause poor COMSEC by our forces.

Photographic Intelligence (PHOTINT). Using photographic equipment aboard aircraft and other airborne platforms to gain information.

Examples:

- Aircraft with infrared and other photo devices.
- Airborne platforms (other than aircraft) to take pictures of US formations.

The enemy can target a variety of methods on your unit, at any given time and in varying degrees of intensity. Most of the time, you won't know what methods are being used against you. But we do have procedures which can effectively deny or hamper the enemy's collection threat, regardless of his methods. The procedures are not necessarily new; the US Army has used many of them before. All procedures that prevent the enemy from collecting information which will give him a tactical advantage are grouped under OPSEC.

THE OPSEC CONCEPT

OPSEC includes all security measures which allow us to maintain surprise. Used successfully, it aids in keeping the enemy from learning:

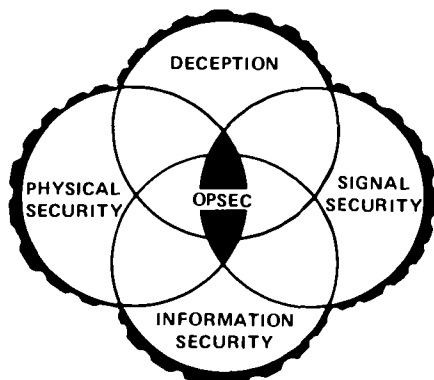
How, when, where, and why we will do something—**THE PLAN**

How, when, where, and why we are doing it—**THE EXECUTION**

How, when, where, and why we did it—**THE AFTER ACTION**

OPSEC consists of four main categories of

security measures. All are interrelated; each must be considered simultaneously for each operation.



Deception is misleading the enemy with regard to our current or intended operations. Deception also includes measures which prevent the enemy from spotting a pattern or stereotyping our actions. Tactical deception plans are provided security by use of the other OPSEC measures. Deception is also used to confuse the enemy when our actions could obviously provide information of our intentions. Unless all OPSEC is practiced, deception plans are vulnerable to hostile exploitation. Likewise, deceptive techniques assist in overcoming vulnerabilities in other OPSEC measures. Examples of deceptive techniques are:

Camouflage

Smoke

Ruse

Feint

Decoy

Demonstration

Physical security is protecting operational information or activity by using security forces (listening posts, observation posts, patrols, guards), barriers (wire, antitank ditches), and anti-intrusion devices (mines, signal flares). These forces deny or limit enemy access to facilities, areas, equipment, material, documents, and personnel.

Signal security is protecting operational information by practicing communications

security (COMSEC) techniques and electronic security (ELSEC) techniques. COMSEC includes communication codes, secure voice equipment, and RTO procedures. ELSEC techniques include radio silence and proper positioning of radars and antennas.

Information security is preventing disclosures of operational information that is contained in written, verbal, or graphic communications. Restrictions are placed on personnel, and the release of operational information and documents to safeguard against unintentional release of data important to the enemy.

THE OPSEC PROCESS

OPSEC proceeds through three steps: analysis, countermeasures, and survey. These steps correspond, respectively, to the planning, execution and after-action of an operation.

Analysis

Conducting an OPSEC analysis is the first step. This analysis is part of the normal staff work in planning each phase of an operation. Three things must be done:

- Estimate the hostile intelligence threat.
- Determine the sensitive aspects of the operation.
- Determine OPSEC vulnerabilities.

The S2 proceeds to obtain the hostile intelligence estimate. Once the S3 has stated the mission, the S2 coordinates with the division G2 or the engineer brigade S2 and other sources to find the answer to two questions: What are the enemy's intelligence collection capabilities? What are the intelligence collection resources of the enemy commander directly opposing us? The S2 will try to determine the impact of those capabilities the enemy is using in the immediate area. A few examples of enemy resources are:

- Ground reconnaissance
- Civilian espionage agents
- Airborne and/or seaborne radar
- Radio direction finding units

- Reconnaissance by all types of airborne platforms
- Sensoring devices
- EW forces

Determining the sensitive aspects of the operation is a joint task of the S3 and S2. They must answer the question: If known by the enemy, what information in what time-frame could compromise the operation? These items are commonly referred to as essential elements of friendly information (EEFI). A few examples are:

- Objective
- Unit conducting the attack
- Task organization
- Reserve location and composition
- Command post location
- Morale
- Unit strength
- Logistical problems and losses
- Combat service support activity, location, and movement

The S3 determines OPSEC vulnerabilities. He coordinates and reviews staff actions necessary to accomplish the mission. He must answer the question: If known by the enemy, what staff actions in what timeframe could provide EEFI? A few examples of these staff actions are:

- Increased requests for replacements
- Convoys containing barrier materials
- Requests for maps of a certain area
- Publication of movement orders
- Preparation of bridges for destruction
- Significant increase in reconnaissance activity of certain areas
- Cannibalization of vehicles
- Movement of combat service support units
- Removal of minefields and other barriers

- Significant increase in radiotelephone traffic

Countermeasures

After the OPSEC analysis is complete, the next step is to plan and execute OPSEC countermeasures. Specific countermeasures are applied to the analysis results to give maximum protection to the operation. All four categories of OPSEC are considered. For example:

Deception

- Camouflaging vehicles, equipment, and personnel
- Using smoke
- Moving logistics at night or during reduced visibility
- Preparing false positions
- Using decoys

Physical Security

- Laying wire obstacles and minefields
- Building antitank obstacles
- Using LP, OP, and patrols
- Limiting access to the TOC area
- Using guards and security forces
- Using challenge and password
- Using foxholes, sandbags, and defilade positions
- Practicing convoy security
- Using overwatch techniques during movement

Information Security

- Briefing all persons on safeguarding security information
- Limiting operational information to persons or units with a "need to know"
- Destroying all classified material
- Limiting "shotgun" message traffic by cutting down the number of information addressees

- Briefing troops at last possible moment
- Refraining from posting operational information on jeep windshields and other nonsecure areas
- Enforcing light and noise discipline
- Clearing any signs of vehicular movement in and out of positions

Signal Security

- Imposing radio silence
- Using wire communication whenever possible
- Enforcing COMSEC procedures
- Directing radar antennas (when calibrating) toward friendly positions
- Dispersing and remoting antennas
- Restricting radar illuminators until enemy is within range
- Minimizing transmission time
- Using low power on radios
- Using secure voice equipment
- Practice electronic counter-countermeasures (ECCM)
- Minimizing all electrically transmitted messages
- Using couriers and messengers whenever possible

Basing his decision on the S3 recommendations and the degree of risk he is willing to accept, the commander decides which countermeasures he will implement. He coordinates these countermeasures with the operations plan or order of his higher headquarters to maintain surprise and security for the entire operation.

Survey

The OPSEC survey is the third step in the process. The purpose of the OPSEC survey is to systematically examine the degree of security given an operation and design measures to improve security for the next operation. In terms of people and time, it is a rather extensive and expensive procedure. Army Regulation 530-1, Operations Security, and the JCS OPSEC Survey Guide give guidance on conducting OPSEC surveys. Because an OPSEC survey must be conducted during the execution phase, it is not usually within battalion capabilities, during combat operations, to conduct such a survey. Higher headquarters, upon request, may assign people to help conduct the survey, and members of your battalion may take part when not engaged in combat operations. The results often give valuable after-action data for determining the effectiveness of the analysis and the countermeasures of the four categories of OPSEC.



Appendix N

COMMAND AND CONTROL

This appendix focuses on the command and control of engineers within the combat zone. Command and support terms are defined and relationships between engineer units and between engineer and maneuver elements are discussed to provide the concepts for control of engineer activities.

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COMMAND RELATIONSHIPS

General

Engineer units are tailored for efficient sustained operations. They range in size from small teams to engineer commands with many subordinate units. The composition and capabilities of engineer units are established in Tables of Organization and Equipment (TOEs).

Engineer units (up to battalion size) are—

- Organic or
- Assigned

Organic Units

Division TOEs include one engineer battalion. TOEs for engineer battalions include other TOE units (companies). These engineer units are organic to the division.

Assigned Units

Above division level, engineer forces are tailored to meet specific requirements. These units are organized into engineer brigades, one assigned to each corps or an engineer command which is assigned to the theater army with primary responsibility to the communications zone (COMMZ). Initially, engineer brigades are assigned engineer battalions and companies, and are capable of a span of control of five to seven battalion equivalents. As more engineer units are required, engineer groups are formed within each brigade. These groups are composed of a group headquarters and several engineer units (battalion and/or companies). The engineer command would expand to several engineer brigades, each constituted as discussed above. Group, brigade, and engineer command headquarters have only their own headquarters and headquarters company organized by TOE. All other units are assigned to these headquarters as part of the tailoring process.

Engineer commands, brigades, and groups are organized and tailored for long-term operations. Specific shorter term operations may require that the system of command and control be temporarily changed.

Organization are tailored for short term operations through—

- Attachment or
- Operational control

Attached Units

Attachment has two basic definitions. The first, from JCS Pub 1, states:

The placement of units of personnel in an organization where such placement is relatively temporary. Subject to limitations imposed by the attachment order, the commander of the formation, unit, or organization receiving attachment will exercise the same degree of command and control thereover as he does over units and persons organic to his command. However, the responsibility for transfer and promotion of personnel will normally be retained by the parent formation unit or organization. Attachment to another headquarters means that all command and logistic responsibilities are transferred to the latter headquarters.

Attachment should be considered when time and space factors make it very difficult—

- For the parent headquarters to logistically support the unit.
- To have a command decision made by the parent unit in time to be responsive to the unit being supported.

The second basic definition for attachment (also from JCS Pub 1) states:

The detailing of individuals to specific functions where such functions are secondary or relatively temporary, i.e., attach for quarters and rations; attach for flying duty.

This definition is frequently expanded to include units. A unit may be in direct support, but attached for rations and POL. This usage recognized the desirability to shorten supply lines wherever possible, and the inherent principle in the US Army to provide logistic support on an area basis.

Units Under Operational Control

For US forces operating within US command jurisdiction, the term "operational control" (OPCON) is defined under the term "operational command" (OPCOM). The terms are synonymous except that operational command is reserved for use by unified and specified commands. OPCOM (and OPCON as a synonymous term) is defined in JCS Pub 1 for DOD usage as:

Those functions of command involving the composition of subordinate forces, the assignment of tasks, the designation of objectives, and the authoritative direction necessary to accomplish the mission.

For example, when a corps engineer combat battalion is placed OPCON to a US division, the division commander has the authority to take units from the battalion and employ them elsewhere in the division.

Engineer units are placed under the operational control of other units—

- When the situation demands the responsiveness of command of the second unit, but that unit does not have the capability to logistically support the former unit.

- When an operation will be so short that continuing logistics support is not important.

A commander may place one of his organic commands under operational control of another of this subordinate commands. Example: A Corps Engr Co place OPCON to the normally associated Divisional Engr Co. He cannot place a unit which is in direct support to his command, or which is in general support to his superior command but operating in his area, under the operational control of one of his subordinate units.

SUPPORT RELATIONSHIPS

Engineer units provide—

- General Support or
- Direct Support.

General Support

General support is defined in JCS Pub 1 as "that support which is given the supported force as a whole and not to any particular subdivision thereof."

If engineers are in general support, they are supporting the command in general. *Any subordinate commander of that command who requires engineer effort must submit requests for that assistance, task by task, to the senior command.* The requests, if approved by the senior command, are grouped by priority with the requests from all other subordinate commanders, and are accomplished in order of priority.

Direct Support

Direct support is defined in JCS Pub 1 as follows:

A mission requiring a force to support another specific force and authorizing it to answer directly the supported force's request for assistance.

An engineer unit placed in direct support provides liaison with the supported unit, advises the supported unit commander on engineer matters, and takes support requests *directly from the supported unit.* In the case of

engineers operating in a division area, the division engineer and the brigade engineer are the single engineer points of contact for the supported maneuver commander.

Corps engineer units operating in a direct support role in a division area establish liaison with, advise, and take support requests *directly from the engineer single point of contact in whose area they are operating*. Command responsibility is retained by the parent engineer unit. Full logistic responsibility rests with the parent engineer unit unless the direct support engineer unit has been attached to the supported unit for certain logistic functions, e.g., rations and POL.

WORK COORDINATION

The coordination of engineer effort within an area of operations is often facilitated by the use of--

- Area assignment and
- Task assignment.

These methods of coordination are used more often in the corps and division rear areas, although they may be appropriate and effective in the forward brigade areas as well.

Area Assignment

Areas are delineated by *engineer work lines* (EWLs). These are boundaries which compartmentalize an operational area to indicate where specific engineer units have primary responsibility for engineer effort. The EWL is a mechanism often used to facilitate the apportionment of work between corps engineer units in the corps rear area and between corps and division engineers in the division area. The EWL may be used by division and brigade engineers to assist in coordinating the efforts of organic and supporting engineers in the division area. They may correspond to maneuver unit areas of responsibility, i.e., sectors, battle areas, and battle positions. By mutual agreement between the corps and division engineers,

there can be established in the division area an EWL to the rear of which all engineer effort is the responsibility of corps engineers. This specific engineer work line is known as the "forward working limit" (FWL). The establishment of all other EWLs within the division or forward of the FWL is the responsibility of division or brigade engineers as the single engineer points of contact. The actual locations of EWLs are fully coordinated with, and consider the advice of, supporting corps engineer commanders.

Task Assignment

The division of workload among several engineer units working within a common area can be achieved by the assignment of tasks to specific units. Maintenance of main supply routes (MSR) between points A and B or the preparation of a strongpoint at location C are examples of the use of tasks to assist in the coordination of operations. The division and brigade engineers as the single engineer points of contact can use the task mechanism to coordinate the efforts of corps engineers working in their respective areas of responsibility.

ESTIMATING ENGINEER EFFORT AND ALLOCATING RESOURCES

Engineer requirements must be analyzed and engineer resource allocations made at each of the following levels of command:

- Corps
- Division

The thrust is to push engineer efforts forward to provide a responsive capability to maneuver units.

At Corps Level

Based on the recommendation of his engineers, the corps commander will apportion engineer effort between the corps rear area and divisions.

Typical questions the corps engineer must consider in arriving at his recommendations are:

- How much work in each area (unit) is to be of a continuing nature?
- Where do temporary requirements exist?
- Where do requirements for specialized units exist?
- Where and how will engineer units be logistically supported?
- Will the communications networks impose limitations on timely decisions to deployed units?
- What are the priorities of work?
- What command/support relationships are appropriate for each required engineer unit?

Large units such as groups or battalions may be placed in direct support, direct support with attachment for logistics only, OPCON, or fully attached to commands. If placed in direct support, the logistics supported by COSCOM units must be modified to allow delivery to forward areas. If fully attached or attached for logistics only, a unit slice of logistics support provided by COSCOM should augment the DISCOM.

Separate company-sized units from corps will find it difficult to obtain adequate logistic support if placed in direct support of the division. Separate corps companies should either be attached to division (normally further attached to the division engineer battalion) or attached to corps battalions designated to operate in the division area.

Platoon- (or smaller) sized units should be attached to a larger engineer unit.

The corps engineer will attempt to:

- Maintain unit integrity.
- Maintain normal association of engineer units to supported units.

Normally, work in the division area will be continuing in nature, and corps engineer units are placed in direct support of a division. However, attachment may be necessary if the situation dictates. If work in

the division rear area is of a continuing nature and the division engineer is less able to plan or control the work than the corps engineer, a FWL is established. Tasks behind the FWL are accomplished by corps engineer units working in general support.

At Division Level

The division engineer's estimate considers the requirements for, and necessary responsiveness of, engineer effort for the maneuver units in the division. He considers his organic battalion's capabilities and the capabilities of augmenting corps engineers. If the total engineer capabilities available to the division are insufficient, the division engineer immediately requests additional corps engineer assets through the corps engineer.

An important consideration in the engineer analysis and estimating process within the division is the *ability of brigade engineers to effectively coordinate total engineer effort in the brigade areas*. The division engineer, in coordination with his brigade engineers, must analyze the command and coordination relationships applicable when two or more engineer companies operate in the brigade area.

If two companies are needed to meet the requirements in a brigade sector, the following options are available:

- The second company may be placed in direct support of the brigade with instructions to obtain tasking priority from the brigade engineer, or
- The second company may be placed OPCON to the normally associated company (if it or its parent unit is attached or OPCON to the division).

If more than two companies are required in a brigade area, the span of control of the normally associated company commander will be overextended. When this situation occurs, the division engineer may—

- Either constitute a task force headquarters out of his organic assets or obtain one from a supporting corps battalion.

- Assign the brigade mission to a corps battalion. In this case, the principle of normal association must be set aside because the task force commander or the corps battalion commander becomes the single engineer point of contact for the maneuver unit.

Task force is formally defined in JCS Pub 1 as "a temporary grouping of units under one commander, formed for the purpose of carrying out a specific operation or mission."

Task force headquarters staffing should provide for a 24-hour command, control, and communication capability. Administrative and logistical elements must be included for longer operations.

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By Order of the Secretary of the Army:

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